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An Analysis of the Forest Resources of Kansas

Earl C. Leatherberry, Thomas L. Schmidt, John K. Strickler, and Raymond G. Aslin

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This report includes the most commonly used U.S. Department of Agriculture, Forest Service, Forest Inventory and Analysis (FIA) statistics. Additional forest resource data can be obtained through FIA staff, through the use of an FIA Forest Inventory Tablemaker CD-ROM, or a table generator on the North Central Research Station's Internet page. Persons requesting special additional information from FIA staff are expected to pay the retrieval costs. Requests may be directed to:

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FOREWORD

Forest Inventory and Analysis (FIA) is a continuing endeavor mandated by the Renewable Resources Research Act of 1978. The objective of FIA is to periodically inventory the Nation's forest land. Up-to-date resource information is essential to frame forest policies and programs. USDA Forest Service regional research stations are responsible for conducting these inventories. The North Central Research Station is responsible for inventorying Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, and Wisconsin.

Fieldwork for the fourth Kansas forest inventory was begun in August of 1993 and was completed in August of 1994. Results of the inventory are based on a sample of 1,200 forested plots and the modeling of 200 undisturbed forested plots from the previous inventory. The reported statistics are estimates. The reader is cautioned to consult the table of sampling errors when using any data contained in this report. Additional funding provided by the Kansas State Legislature to the Kansas Forest Service allowed for an increased level of sampling. Field work for the inventory was expedited through the cooperation and assistance of the Kansas Forest Service. In addition, the Kansas Forest Service surveyed primary wood-using plants in Kansas to determine current timber removals. The USDA Natural Resources Conservation Service conducted a National Resource Inventory (NRI) in 1992 that included Kansas forest area. Larry Kuder, NRI Coordinator for Kansas, provided information on NRI primary sample units so that the FIA inventory would be coordinated with the 1992 NRI report.

In this report, we compare statistics from the 1994 inventory with statistics from the 1981 inventory. These comparisons were made to indicate trends in forest resources. Comparison of data from the 1994 inventory with data from the 1981 inventory is valid because data from the previous inventory were reprocessed using the 1994 procedures. For more information, please refer to "Comparing the Fourth Inventory of Kansas with the Third Inventory" in the appendix.

The fourth inventory of Kansas was directed by Neal Kingsley (retired), FIA Program Manager, North Central Research Station, St. Paul, Minnesota. John Strickler (retired), Kansas Forest Service, coordinated the State's responsibilities. St. Paul FIA staff involved with the Kansas forest resources inventory were: Beth Collins, Sheri De Cora, Barb (Freund) Fuller, Tom Gearhart, Dan Goodman, Dale Gormanson, Ron Hackett, Mark Hansen, David Haugen, Doug Hecker, Jennifer Iole, Mike Johnson, Barb Knight, Troy Lindgren, Joel Lemberg, Doug Magee, Dennis May, Pat Miles, Jerry Ostrom, Ron Piva, Gerhard Raile, Mary Jo Resendez, Tom Schmidt, Jay Solomakos, Dan Wendt, and Susan Willhite. FIA field staff members were: Todd Anderson, Kurt Buckler, Mark Gossman, William Groth, Dean Halvorson, Cheri Hartless, Patrick Hartless, Glenda Hefty, Ronald King, Christina Krie, Joel Lemberg, Kristen (Bailey) Lombard, Kyle Lombard, Jeffery Morse, Kindall Nyquist, Lawrence Plucinski, Trevor Sommers, Eric Stanton, Richard Steensma, Andrew Tuttle, James Veiman, Brad Witkin, and Erin Witkin.

HIGHLIGHTS

- Forest land area in Kansas increased by more than 183 thousand acres between 1981 and 1994, rising to 1.5 million acres. Timberland accounts for 96 percent of the State's forest land area.

- Ninety-four percent of the timberland is privately owned. Individual non-industrial private owners, with 89 percent of all timberland, make up the largest ownership group.

- Most private timberland is in small parcels—61 percent of all private timberland is owned by people who have fewer than 50 acres of timberland.

- Kansas timberland is dominated by hardwood stands. The elm-ash-locust forest type occupies about one-third of the State's timberland area (479 thousand acres).

- Sawtimber stands predominate, occupying 48 percent of the timberland area. Sawtimber and poletimber stands increased in area between 1981 and 1994, and the area of sapling-seedling stands remained static.

- The volume of growing stock increased from 877 million cubic feet to 1.3 billion cubic feet between 1981 and 1994, a 43-percent gain. Sawtimber volume increased from 3.1 billion board feet to 4.4 billion board feet between inventories, also a 43-percent gain. Approximately three-fourths of the growing-stock volume is in six species groups—cottonwood, hackberry, red oaks, white oaks, ashes, and black walnut. These six species groups account for more than three-fourths of the sawtimber volume.

- Short-log trees contain significant board foot volume—651.8 million board feet. Short-log trees meet local merchantability standards of one or more 8- to 11-foot saw logs, but not the national standard of a 12-foot saw log.

- Between 1981 and 1993, timberland in Kansas averaged 25.8 million cubic feet of net growth each year for growing stock, about 2.1 percent of the State's growing-stock volume. Nearly half of the State's total net annual growth in growing stock was in two species groups, hackberry (27 percent) and oaks (20 percent).

- Mortality rates for growing-stock volume increased between inventories, going from 1.6 percent of inventory in 1980 to 1.9 percent in 1993. The sawtimber mortality rate edged upward from 1.5 percent of inventory in 1981 to 2.1 percent in 1993.

- Average annual timber removals from growing-stock volume amounted to 8.1 million cubic feet during the period 1981 to 1994—about 30 percent of average annual growth. Average annual removals of sawtimber (30 million board feet) as a percent of average annual growth (92 million board feet) was 33 percent.

- In 1993, the primarily wood-using mills in Kansas processed nearly 2.2 million cubic feet of roundwood into lumber and other products.

- Manufacturing establishments in the lumber and wood industries employed 3,215 people and paid $64.5 million in wages and salaries in 1994.

- Forest land in Kansas provides critical habitat for wildlife species that are included on either Federal or State lists of endangered or threatened species. Examples of forest-dependent wildlife species that are of special concern include the eastern spotted skunk, bald eagle, broadhead skink, and northern spring peeper.

- Forest land in Kansas provides critical habitat for wildlife game species. White-tailed deer are the most economically important big game animal in the State; more than 34,000 were harvested in 1994. The deer harvest helped generate $44 million of expenditures by outdoor recreationists.

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An Analysis of The Forest Resources of Kansas

Earl C. Leatherberry, Thomas L. Schmidt, John K. Strickler, and Raymond G. Aslin

Most people think of Kansas as a place where wheat fields stretch to the horizon only to be broken by vast areas of prairies. Indeed, much of the Kansas landscape is devoted to agriculture. However, another component of the Kansas landscape is often overlooked. Forests and land with trees occupy a relatively smaller area, but are prominent components of the landscape. This report presents an analysis of the Kansas forest resources as of 1994. Information presented is from the fourth Kansas forest resources inventory, completed in 1994, conducted by the USDA, Forest Service, in cooperation with Kansas Forest Service. Previous inventories were completed in 1936 (Ware and Smith 1939); 1965 (Chase and Strickler 1968); and 1981 (Spencer *et al.* 1984). In this analysis, we provide an overview of how forest land[1] in Kansas has changed over the years. We focus on timberland that accounts for 96 percent of the forest land area. We describe the extent, structure and composition, and productivity of timberland, and we discuss factors that influenced recent changes in timberland. We point out some of the economic benefits provided by the forest products industry. We discuss the importance of nontimber benefits and values that forests and other land with trees provide. And lastly, we discuss what we think forest lands in Kansas will be like in the future.

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HISTORICAL OVERVIEW OF KANSAS FOREST

In historic times, the region that is now Kansas never supported much forest. Before human settlement, forests covered only about 8 percent of the State's land area (Ware and Smith 1939). The presettlement natural vegetation consisted mostly of prairie grasses and scattered groves of trees. Fire was a dominant force in limiting trees because it prevented woody plants from invading grassy areas. Also, in western Kansas, grasses were the dominant vegetation because they were better adapted to periods of drought than most tree species.

The original forest of Kansas was located predominantly in the eastern part of the State where precipitation was adequate for tree growth. There, forests existed on rich alluvial bottom lands and on moist upland sites. Moving from east to west across the State, forest land was more and more confined to river valleys, slopes, and steep or hilly areas. In some places, such as the Red Hills region of south-central Kansas, eastern redcedar *(Juniperus virginiana)* trees were found scattered savanna-like over the prairie. Groves of deciduous trees and shrubs occurred in valley bottoms and on north-facing slopes throughout much of the region (Küchler 1974). In the drier reaches of western Kansas, the landscape was virtually void of forest, except for small groves or forest islands found on the high plains in coves or other protected areas.

[1] *See Definition of Terms in the appendix for this and other terms used in the report.*

Over the past several hundred years, humans have had an accelerating influence on the nature and extent of forest land in Kansas. The Kansa and Osage Indians were among the first settlers in the region, and were active in shaping the structure and extent of forest land. In eastern Kansas, they cleared forest in river valleys for agricultural activities. On the prairies and plains, tribal groups known as the Pawnee and Kiowa people used fire to prepare range land for spring grazing by the American bison *(Bison bison)* and pronghorn antelope *(Antilocapra americana)*. Those periodic human-caused fires, along with lightning-caused fires, limited forest expansion.

When European settlers first arrived in the region, they were attracted to the 4.5 million acres of forest land that existed in what is now Kansas. Those settlers, most from the Eastern United States or northwestern Europe, believed like the native people before them, that only forest land could be farmed successfully. The timbered-covered alluvial valleys of the rivers in eastern Kansas were the first lands to be settled by European-Americans (Ware and Smith 1939). Those settlers cleared much of the land of its original forest cover, not only for agriculture, but for building material, fencing, and fuel. By about 1860, many of the counties in eastern Kansas had reached populations of more than 10,000 residents (Edmondson and Miller 1997). Those counties were rapidly settled because they were places where field crops could grow without irrigation.

As settlement expanded onto the prairie, State and Federal governments established tree planting initiatives. The Kansas legislature, for example, passed laws providing financial incentives for any person who planted and cultivated 5 or more acres of trees (Ware and Smith 1939). The Timber Culture Act of 1873 dispensed Federal land to settlers and included tree planting as an enticement. Government tree-planting initiatives were intended to increase tree cover in order to modify the climate and provide much needed supplies of lumber, fence posts, and fuel. In addition, many people who established homesteads on the prairie brought seedlings and other plantings with them in an attempt to recreate remnants of forest environments they were familiar with (Schaefer *et al.* 1987). For many settlers, trees provided psychological relief from the harsh climate and unending space of the Great Plains (Sutton 1985). However, periodic drought as well as lack of management took a toll on trees that were planted (Ware and Smith 1939).

As agriculture expanded and more virgin sod was plowed, periodic crop failures and the resultant severe wind erosion contributed to the well-known "Dust Bowl" era. The period of severe drought during the 1930's accentuated the importance of trees to dry land agriculture on the Great Plains. Subsequently, the Federal government established programs that planted thousand of acres of tree windbreaks in Kansas. Tree windbreaks proved to be a necessary and vital part of dry land agriculture because they minimized soil loss from high winds.

By 1936, forest land in Kansas had been reduced to approximately 1.2 million acres (Ware and Smith 1939). Most of the forest land in Kansas occurred naturally, but some was in plantations or field plantings such as farmstead windbreaks, farm woodlots, and rural school plantings. Between 1936 and 1965, forest land increased by about 112 thousand acres, or by 9 percent, to nearly 1.4 million acres. The increase was due largely to natural tree regeneration on idle pasture and cropland, rather than artificial reforestation (Chase and Strickler 1968). Also, controlling and suppressing wildfires led to an increase in forest land area. Wildfire control efforts became more effective after World War II as excess federal property was made available for use in rural volunteer fire districts. The Kansas Forest Service played a significant role in organizing fire districts and in distributing critically needed equipment.

Between 1965 and 1981, forest land increased by 8.9 thousand acres to more than 1.4 million acres. Forest land accounted for 3 percent of the State's total land area. The greatest single impact on the State's forest land between 1965 and 1981 was the death of many American elms *(Ulmus americana)* from Dutch elm disease (Spencer *et al.* 1984).

Natural wooded strips—found mostly along rivers and streams, and planted windbreaks—are important components of the landscape.

Most wooded strips and windbreak plantings, however, do not qualify as forest land under the FIA definition because of their narrow, linear nature. Nonetheless, they have played an important role in Kansas history. For example, in some areas, "living fences" of Osage-orange *(Maclura pomifera)* were planted. It is estimated that farmers in Kansas planted 34 thousand miles of single-row Osage-orange hedges between the middle of the 19th and the middle of the 20th centuries (Stoeckeler and Williams 1949). Many of these Osage-orange hedgerows still exist today in Kansas.

In 1965, the total area of wooded strips in Kansas was estimated to be 215 thousand acres (Chase and Strickler 1968). In 1981, wooded strips and windbreaks combined occupied 333 thousand acres (Spencer *et al.* 1984). However, in some parts of the State, the area of wooded strips and windbreaks has declined. For instance, Sorenson and Marotz (1977) reported a 20-percent decrease in wooded strips between the late 1950's and early 1970's for a 13-county area in central Kansas. It is difficult to draw firm conclusions about the area of wooded strips and windbreaks because of differences in survey definitions and area covered. It does appear, however, that at any given time, the area of wooded strips and windbreaks was dependent on the attitude of landowners toward them.

EXTENT OF KANSAS FOREST LAND—1994

Area of Forest Land Continues to Expand

In 1994, forest land in Kansas totaled more than 1.5 million acres, up by 13 percent from the nearly 1.4 million acres present in 1981. The increase in forest land continues a trend started in 1936 of expanding with each successive inventory. Today, forest land accounts for almost 3 percent of the total land area in the State. Virtually all (96 percent) Kansas forest land is classified as timberland. Of the remainder, 17 thousand acres is reserved timberland, and 37 thousand acres is classified as other forest land (land that was classified as forest land but that was not sufficiently productive to be classified as timberland). The increase in forest land area between 1981 and 1994 is due primarily to trees becoming established on abandoned croplands and pastures.

Although planting trees has been an important activity since the mid-1800's, nearly all of the forest land in Kansas is naturally occurring. In 1994, plantations accounted for only about 2 thousand acres of the State's forest land area. However, while the area of plantations is small, the overall area of land planted to trees in Kansas is much larger. For instance, in 1994, more than 2 thousand acres of land was planted to trees (Moulton *et al.* 1995). The vast majority of land planted to trees was classified as nonforest land with trees, primarily due to the plantings not meeting the minimum requirements to qualify as forest land.

Forest Land Concentrated in Eastern Kansas

Because of its midcontinental climate and the influence of moisture from the Gulf of Mexico, Kansas experiences a wide range of seasonal temperatures and precipitation patterns that influence where trees grow. To facilitate regional analyses of forest resources, Kansas is divided into three units—the Northeastern, Southeastern, and Western Survey Units (fig. 1). The largest areas of forest land are in the Southeastern Unit (687 thousand acres) and the Northeastern Unit (594 thousand acres). In both the Southeastern and Northeastern Units, forest land accounts for approximately 7 percent of the land area. In the Western Unit, forest land accounts for less than 1 percent of the land area (265 thousand acres).

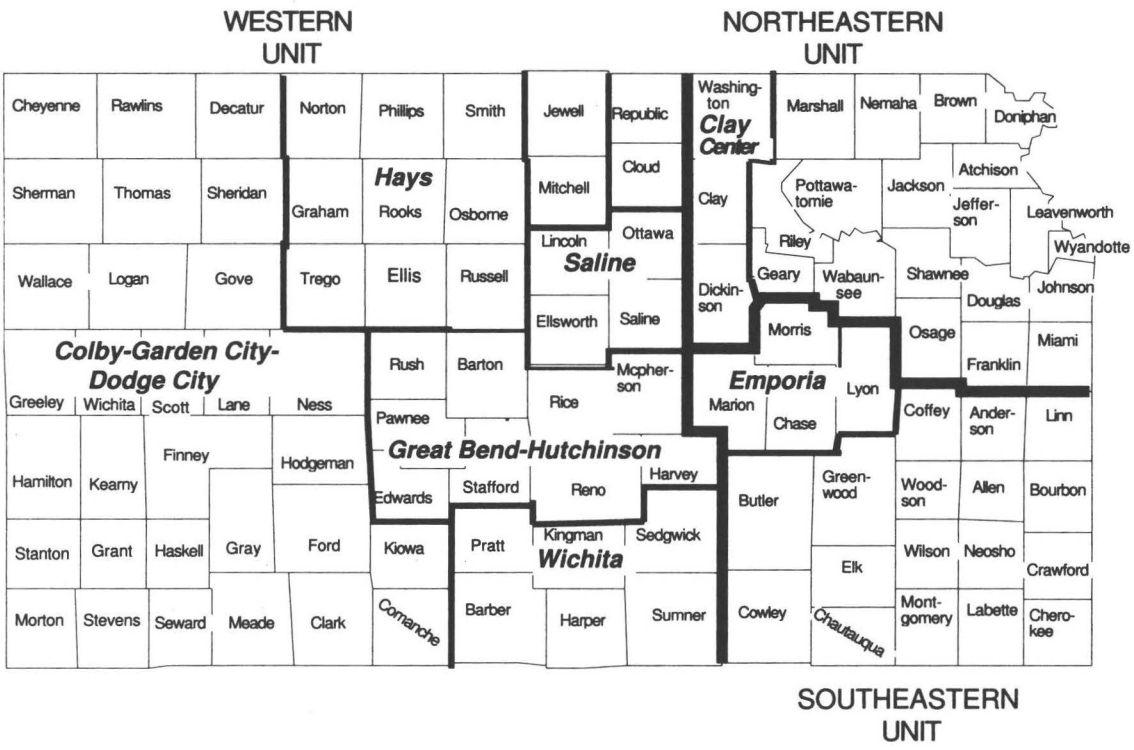

Figure 1.—*Forest Survey Units and county groupings, Kansas, 1994.*

The regional difference in the spatial distribution of forest in Kansas is clearly reflected in the significant role climate plays in determining the presence of woody vegetation. In the vast plains of western Kansas, woody vegetation growth is limited by low precipitation and the sometimes harsh and extreme weather. Trees are often found only in windbreaks, rural communities, or on protected moist sites. In eastern Kansas, higher precipitation and more moderate weather are more conducive to tree growth. Certain tables in the appendix present forest statistics at the county or county grouping level. Please see figure 1 and "Table Titles" in the appendix for a listing of counties or county grouping tables.

In Kansas, county boundaries mostly follow parallels and meridians. Those boundaries, conceived for political or legal reasons, are not representative of natural or ecological units. To present forest statistics within an ecological landscape context, we used the 12 major river basins in the State as distinct ecological units (fig. 2). River basins were used because they are easily delineated, and in much of the State, forest communities occur along river valleys. Tables 57-60 in the appendix under "Supplemental Tables" contain area and timber volume statistics by river basins. Because we categorized only limited data by river basins, the analysis of the State's forest resources will focus on Forest Survey Units.

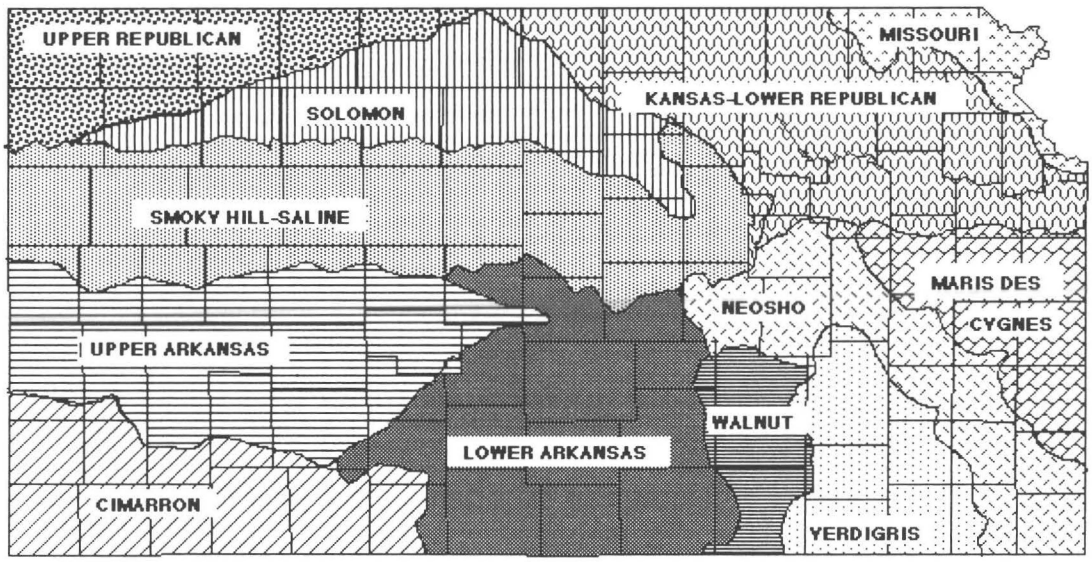

Figure 2.—*Major river basins, Kansas. (Map based on information provided by the Kansas Water Office.)*

Reserved Forest Land

In 1994, 17 thousand acres of forest land were classified as reserved forest lands. The area of reserved forest land was about evenly split between the Northeastern and Western Units. The majority—about 70 percent—of reserved forest land is federally owned and is associated with designated recreation areas, wildlife refuges, or conservation/preservation sites.

Nonforest Land with Trees and Other Forest Lands

In Kansas, some areas with trees are not considered forest land; instead, they are classified as nonforest land with trees. To be classified as nonforest land with trees, an area must contain at least one tree per acre that is at least 5 inches in diameter at breast height (d.b.h.). In 1994, there were almost 1.9 million acres of nonforest land with trees. More than 56 percent of the nonforest land with trees was pasture land as shown below:

Nonforest land with trees	Area (Thousand acres)
Pasture	1,071.2
Wooded strips/windbreaks	483.7
Urban and other	232.9
Cropland	68.0
Idle farmland	26.2
Marsh	15.2
Total	1,897.2

Wooded strips and windbreaks accounted for the second largest classification of nonforest land with trees. There were almost a half-million acres of wooded strips and windbreaks, representing about one-fourth of the total area of nonforest land with trees (fig. 3). The most common species of native trees in wooded strips is cottonwood *(Populus deltoides)*. In windbreaks, one of the most common planted species is eastern redcedar. Osage-orange is also common in plantings.

Characterizing the extent and condition of wooded strips, windbreaks, and other linear

Figure 3.—*Wooded strips, like these following a meandering stream, are often intermixed with pockets of riparian forest.*

tree plantings can be difficult. For instance, we found that between 1981 and 1994, those areas expanded by 150 thousand acres, to nearly 484 thousand acres. However, other studies suggest that area of wooded strips and windbreaks in Kansas has declined (Sorenson and Marotz 1977, Baltensperger 1987). Still other studies are inconclusive. For instance, a recent study reported that in Kansas, windbreaks were being planted at a rate exceeding the rate of removal (Cable 1992). However, it was concluded that when survival rates are considered, the increases may not be enough to maintain the existing area of windbreaks (Cable 1992).

In general, nonforest land with trees offers few opportunities for management and harvest on a commercial basis for wood fiber. However, they are very useful as resources for shading of livestock, erosion control, real estate protection, and as wildlife production/shelter areas. Also, nonforest lands with trees are an important source of residential fuelwood. In 1994, of all fuelwood cut in Kansas to meet residential fuelwood demands, about 60 percent (26 million cubic feet or 204 thousand cords) was produced from nonforest land, mainly pastures and cropland (May 1996). Osage-orange, a species often associated with nonforest land with trees, produces wood that is extremely durable and immune to termites, making it ideally suited for fence posts. Although it is not considered a commercial species, one thousand cubic feet of Osage-orange roundwood was delivered in 1993 to wood-using mills in Kansas for processing (Hackett and Strickler 1996).

Thirty-seven thousand acres of forest land was classified as other forest land in 1994. Other forest land is land that is not sufficiently productive to be classified as timberland because of adverse conditions. Adverse conditions in Kansas include sterile or shallow soils, dry climate, poor drainage, steepness, and rockiness. Trees growing on other forest land are usually widely spaced and scrubby. Because Kansas is largely a prairie state, any land that supports trees is vitally important. The presence of a single tree or grove of trees can contribute rather significantly to the ecosystem, as well as evoke emotional responses from humans, such as by filling the human need for spatial diversity.

TIMBERLAND

Timberland Area Increased

Timberland is that portion of forest land capable of producing industrial wood and not withdrawn from timber utilization or associated with urban and rural development. Timberland area in Kansas totaled 1.5 million acres in 1994, an increase of 279 thousand acres over what was present in 1981. Statewide, 96 percent of the forest land is timberland. The Southeastern Unit contained 44 percent (661.7 thousand acres) of the State's timberland area, followed by the Northeastern Unit with 39 percent (582 thousand acres), and the Western Unit with 17 percent (248 thousand acres). Between 1981 and 1994, the increase in timberland area occurred in the Southeastern and Western Units. The Southeastern Unit increased in timberland area by 223 thousand acres, a 50-percent gain. The Western Unit had an increase in timberland area of nearly 67 thousand acres, a 37-percent gain. The Northeastern Unit declined by nearly 11 thousand acres, a 2-percent drop.

The significant increase in timberland area in the Southeastern Unit can be attributed to several factors. First, some unproductive forest land in 1981 was found to be productive in 1994 and was reclassified as timberland. For instance, in 1981, nearly 100 thousand acres were classified as unproductive, but in 1994, only 25 thousand acres were similarily classified. Second, some land that was classified in 1981 as cropland or pasture was reclassified as timberland in 1994. For example, land that was classified as cropland without trees declined by 908 thousand acres between inventories. On some of those abandoned croplands and pastures, trees became established, and in 1994, those lands met the definition of timberland.

TIMBERLAND OWNERSHIP

Most Timberland Privately Owned

Ninety-four percent (1.4 million acres) of the State's timberland area is held in private ownerships—individual or corporate owners (fig. 4). About 9 of every 10 acres of timberland in Kansas are held by individuals or joint owners, such as family groups. Only 5 per-

cent (75 thousand acres) of timberland is owned by private corporations. Most of the remaining 6 percent of timberland in Kansas is held in public ownership. The Federal government is the largest holder of public timberland with 53 thousand acres. Timberland held in trust by the United States for tribes or groups of American Indians totals less than 1 percent of the State's timberland area, about 3 thousand acres.

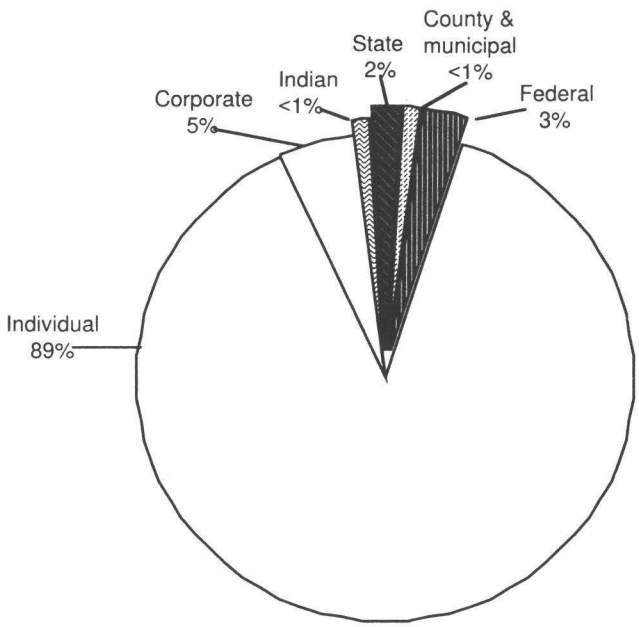

Figure 4.—*Timberland area by ownership class, Kansas, 1994.*

Most Private Timberland in Small Parcels

Sixty-one percent of the privately owned timberland (858 thousand acres) is held by owners who control fewer than 50 acres of timberland. Most of that—nearly 723 thousand acres—is held by owners with 11 to 50 acres of timberland. Another 24 percent is owned by owners holding from 51 to 100 acres, and about 2 percent is owned by owners holding more than 500 acres of timberland, as shown in the following tabulation. (These areas represent the total area of timberland owned by an owner, and may include one or more non-contiguous tracts of timberland.)

Size of holding (Acres)	Timberland area owned by private owners (Thousand acres)
1-10	135.0
11-20	268.5
21-50	454.3
51-100	341.7
101-500	168.7
500 +	29.2
Total	1,397.4

Public Timberland Expanded

Publicly owned timberland accounts for only a small proportion of the timberland area in Kansas. However, between 1981 and 1994, the area of public owned timberland expanded from about 47 thousand acres to almost 92 thousand acres. The majority of publicly owned timberland is associated with U.S. Army Corps of Engineers or Bureau of Reclamation reservoir projects and with State parks or conservation areas. Note that the increase in public land ownership of timberland is probably not a reflection of an overall increase in public ownership but rather an increase in trees on existing acres resulting in the reclassification as timberland. For instance, many of the acres around public reservoirs have reverted back to trees from agricultural use after public acquisition during the 1950's and 1960's. Also, it should be recognized that the smaller acreage of public land sampled provides a greater potential for sampling error than privately owned timberland.

COMPOSITION AND STRUCTURE OF KANSAS TIMBERLAND

Hardwood Stands Dominate

Timberland in Kansas supports mostly hardwood stands, except for scattered stands of eastern redcedar. The elm-ash-locust forest type occupies about one-third of the State's timberland area (479 thousand acres) and is the dominant forest cover in each of the Forest Survey Units. Between the last two inventories, the elm-ash-locust type expanded in area by more than 70 thousand acres (fig. 5). The predominance of the type throughout Kansas is indicative of the adaptive capabilities of the tree species in this type. Many of the tree species associated with the elm-ash-locust type, especially elm, green ash *(Fraxinus pennsylvanica)*, and honeylocust *(Gleditsia*

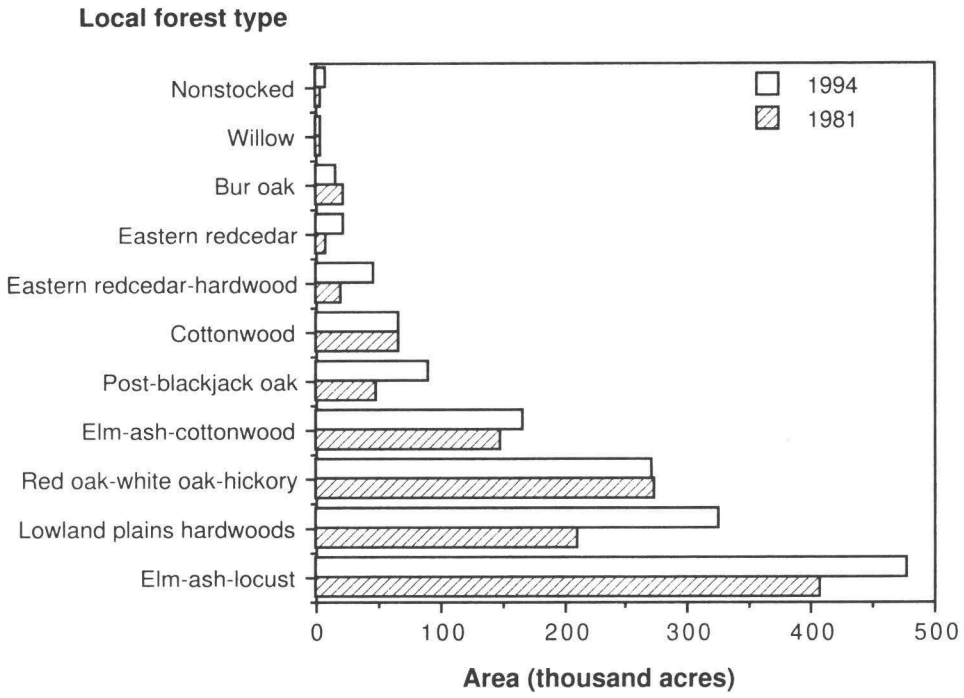

Figure 5.—*Area of timberland by local forest type, Kansas, 1981 and 1994.*

triacanthos), develop best on deep, rich, moist sites. However, they also do well on dry sites that characterize much of western Kansas where there is an estimated 104 thousand acres of timberland in the type. The lowland plains hardwoods forest type is the second most extensive type in Kansas, occupying 22 percent of the timberland area (326 thousand acres) (fig. 6). The third most extensive forest type in Kansas is the red oak-white oak-hickory type, occupying 18 percent of the timberland area (270.1 thousand acres). Like the lowland plains hardwoods, the red oak-white oak-hickory type is largely restricted to eastern Kansas where soil moisture and local climatic conditions are favorable for the development of tree species common to the types.

Post-blackjack oak and lowland plains hardwoods forest types increased significantly in area between inventories. The post-blackjack oak forest type increased by 86 percent, from more than 48 to nearly 90 thousand acres. The type is concentrated in the Southeastern Unit, where it occupies 13 percent of the Unit's timberland area. Between inventories, the area of lowland plains hardwoods expanded by 55 percent, from 210 to 326 thousand acres. Most of the increase occurred in the Southeastern Unit where the type increased to 145 from 79 thousand acres, an 83-percent gain. Also, in the Western Unit, the lowland plains

Figure 6.—*This stand of lowland plains hardwoods is typical of forest stands in southeastern Kansas.*

hardwoods type increased in area between inventories by about 15 thousand acres, rising to nearly 44 thousand acres. Most of the area in the lowland plains hardwoods forest type in the Western Unit contained mostly green ash

and hackberry *(Celtis occidentalis)* trees. Note that some tables in the appendix have local forest types grouped under FIA national forest types. The national type does not necessarily reflect actual species occurrence. For example, the lowland plains hardwoods type is under the national maple-beech-birch forest type, but there are no beech *(Fagus)* and relatively few river birch (*Betula nigra)* in Kansas. National types are listed to facilitate national reporting and comparisons.

Cottonwood Forest Type Continued to Decline

There were 66 thousand acres of timberland in the cottonwood forest type in 1994. Cottonwoods were once the dominant tree cover on the flat, sandy, bottom lands of the State's rivers and streams. The species was widely planted by the early European settlers because it grows fast, develops a large open crown, and is able to withstand the often extreme weather conditions common to the State. However, the area of cottonwood forest type has declined since the 1930's as illustrated below.

Year of inventory	Area of cottonwood forest type (Thousand acres)
1936	107.0
1965	74.2
1981	67.0
1994	65.5

Eastern Redcedar Forest Type Expanded

During the 13 years between inventories, area in the eastern redcedar type increased from 8 thousand acres to 23 thousand acres—a 174-percent increase. Stands in the eastern redcedar type are typically pure eastern redcedar stands. The eastern redcedar-hardwood forest type also increased in area. In 1981, there were 20 thousand acres of timberland in the eastern redcedar-hardwood forest type. Between inventories, area in the eastern redcedar-hardwood forest type increased by 25 thousand acres to 46 thousand acres—a 125-percent increase. In the eastern redcedar-hardwood type, hardwoods represent the majority of the stocking, but eastern redcedar makes up between 25 and 50 percent of total stocking.

Together, the eastern redcedar and eastern redcedar-hardwood forest types occupied 5 percent of the State's timberland area in 1994 (up from 2 percent of all timberland in 1981). Between inventories, 40 thousand acres of timberland where eastern redcedar was a dominant species was added to the timberland base. This equates to an average of 3 thousand acres of land being added yearly where eastern redcedar had a significant presence. Stands with eastern redcedar as the dominant species are most common in the Southeastern Unit, where there are nearly 36 thousand acres. This represents about one-half of the State's eastern redcedar resource. Although occupying a relative small portion of the State's timberland area, eastern redcedar is an important component of the landscape and is ecologically valuable because it is the most widely distributed conifer tree in Kansas. Note, however, that eastern redcedar is sometimes perceived to be a problem, especially where it invades pastures and rangeland and affects forage production and its use.

Nonstocked Timberland Increased in Area

The area of nonstocked timberland in Kansas increased from 4 to more than 7 thousand acres between 1981 and 1994. Nonstocked timberland is land that has forests as its primary land-use but that did not have enough trees present during the inventory to be classified as a forest type. About half the nonstocked timberland in Kansas is in the Northeastern Unit. Some of this land, especially areas near cities in the Unit, may be in the process of being converted to urban uses as urban expansion continues.

Sawtimber-Size Stands Predominate

Sawtimber-size stands account for the largest area of any stand-size class—712 thousand acres, or 48 percent of the total timberland area (fig. 7). Sawtimber stands have long predominated in Kansas. Starting with the 1936 inventory and in each succeeding inventory, sawtimber stands accounted for roughly half the State's timberland area. Between 1981 and 1994, the area of sawtimber size-stands increased by 101 thousand acres, a 17-percent increase. Poletimber stands occupied almost 472 thousand acres of the State's

timberland area in 1994. Between inventories, poletimber stands experienced a 58-percent increase in area, rising from 25 percent of timberland area in 1981 to 32 percent in 1994. The area of sapling-seedling stands accounted for 20 percent of Kansas timberland in 1994 and did not change appreciably between inventories.

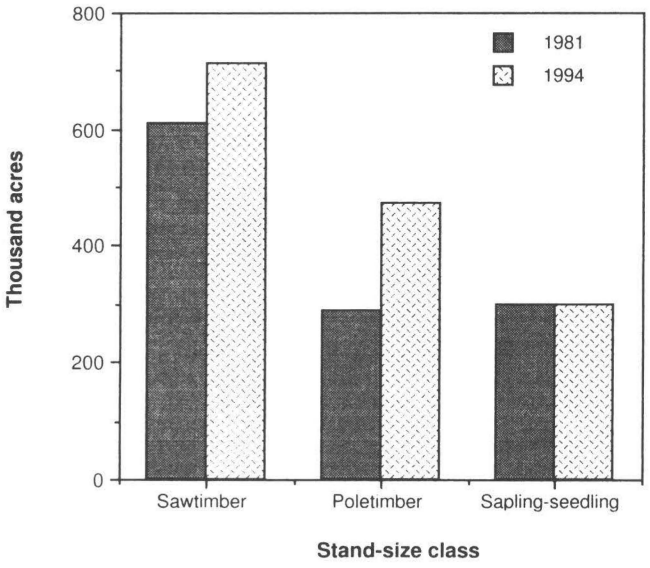

Figure 7.—*Area of timberland by stand-size class, Kansas, 1981 and 1994.*

The expanding and dynamic nature of the forests of Kansas can be seen in changes that occurred in stand-size class distribution between inventories. The rather substantial increase in area of poletimber stands reflects the evolving and expanding nature of timberland. Some of the increase in poletimber stand area is the result of pasture land with trees being reclassified as timberland in 1994. The lack of change in area of sapling-seedling stands between inventories suggests that some of the increase in timberland area came from established trees. However, the area of eastern redcedar and eastern redcedar-hardwood sapling-seedling stands increased by almost 16 thousand acres. These young trees characterize the rapid expansion of eastern redcedar. Conversely, some other forest types declined significantly in sapling-seeding area. Most notable were the red oak-white oak-hickory forest type with a decline of nearly 28 thousand acres, and the elm-ash-cottonwood type with a decline of 8 thousand acres in sapling-seedling-size stands. The decline of area in sapling-seedling stands was concentrated in the Northeastern Unit, where areas of timberland are under pressure from urban expansion.

Number of Trees Increased, But Number of Walnut Trees Declined

In 1994, there were an estimated 609 million live trees larger than 1 inch in diameter at breast height (d.b.h.) on timberland in Kansas. Between 1981 and 1994, the number of trees increased by 31 percent, from 463 million trees. On average, about 12 thousand trees were added annually to timberland in Kansas between 1981 and 1994. However, some species did not experience an overall increase in number of trees. Species that declined in number of trees between inventories were basswood *(Tilia americana)*, sugar maple *(Acer saccharum)*, sometimes called hard maple, sycamore *(Platanus occidentalis)*, cottonwood, black willow *(Salix nigra)*, and black walnut *(Juglans nigra)*.

The decline in the number of black walnut trees is of special concern because it is an important lumber species. The decrease in the number of black walnut trees was confined to the 1- to 6.9-inch diameter class. In 1981, there were 21 million black walnut trees under 6.9 inches d.b.h. By 1994, the number of trees in that size group had declined to 16 million trees, about a 22-percent loss. The loss of black walnut trees in the smaller diameter classes portends a reduced number of walnut trees in the future.

Biomass

The vegetative complex that makes up forests is comprised of a variety of different plants. The woody non-tree vegetation is an important component of the forest environment. As we explore the composition of forest land, it is also important to know how much of which plants are present, including shrubs and small seedlings. In the 1994 inventory, the field staff collected information on the aboveground biomass of live trees and shrubs on timberland. Aboveground biomass of all live trees at least 1 inch d.b.h. amounted to nearly 95 million green tons (weight of live, green trees) in 1994, or an average of 63 green tons per acre. The elm-ash-locust forest type accounted for 28 million green tons, 30 percent of the total, followed by the lowland plains hardwoods

type with 21 million green tons (23 percent), and the red oak-white oak-hickory type with 18 million green tons (19 percent).

The cottonwood type contained the largest biomass per acre—96 green tons. The elm-ash-cottonwood type followed with 77 green tons per acre, ahead of the bur oak (73 tons), the lowland plains hardwoods (66 tons), and red oak-white oak-hickory (65 tons). The least biomass per acre was in the willow type (21 tons) and the eastern redcedar type (22 tons).

Difference in biomass among forest types depends on the variation in the specific gravity of individual tree species and the mix of species in a forest type. The greatest share of live tree biomass is in the boles of growing-stock trees (42 percent) as shown in the following tabulation:

Biomass component	Weight (Million green tons)	Percent
Growing-stock trees >5 in. d.b.h.:		
Stumps	3.4	4
Boles	39.9	42
Tops and limbs	11.4	12
Non-growing-stock trees >5 in. d.b.h.:		
Stumps	2.1	2
Boles	24.3	26
Tops and limbs	6.9	7
Live 1- to 5-in. trees	6.7	7
Total	94.7	100

The biomass of shrubs includes biomass of live tree seedlings less than 1 inch d.b.h., tall shrubs, and low shrubs. The mean shrub biomass on timberland in 1994 was 2.7 thousand pounds per acre green weight, of which 32 percent (864 pounds per acre) was in tree seedlings, 62 percent (1,692 pounds per acre) was in tall shrubs, and 6 percent (166 pounds per acre) was in low shrubs.

Among species of tree seedlings, elm produced the largest mean biomass (165 pounds per acre), followed by hackberry (133 pounds per acre). Among tall shrubs, roughleaf dogwood *(Cornus dummondii)* by far produced the largest mean biomass per acre at 562 pounds per acre green weight. No other tall shrubs exceeded 100 pounds per acre green weight.

Among low shrubs, Virginia creeper *(Parthenocissus* spp.) produced the largest mean biomass (43 pounds per acre), followed by poison ivy *(Rhus radicans)* (35 pounds per acre).

PRODUCTIVITY OF TIMBERLAND

Timberland Has High Productive Capacity

Land in Kansas has a high agricultural productivity, as shown in the State's consistent place among the nation's leaders in wheat production. In terms of wood production, an important question is, how productive is the State's timberland? The capacity of timberland to grow crops of industrial wood can be assessed by estimating cubic feet of growth per acre per year at culmination of mean annual increment of a fully stocked natural stand. Potential productivity of a stand is related to the site's inherent capacity to grow trees and generally does not change over time. In 1994, 21 percent of the timberland in Kansas had a potential productivity of more than 85 cubic feet per acre per year as shown in the tabulation below:

Unit	Potential productivity class, cubic ft of growth /acre/year	
	85+	20-84
	(Percent of timberland)	
Northeastern	21	79
Southeastern	25	75
Western	14	86
Total	21	79

In general, timberland in Kansas has good productive capabilities. To illustrate, we compared the potential productivity of timberland in Kansas with timberland in Missouri, Michigan, and Minnesota. Missouri had only an estimated 6 percent of its timberland with a potential productivity capacity of 85 or more cubic feet of growth per acre per year (Spencer *et al.* 1992). The proportion of timberland that has a potential productivity capacity of more than 85 feet per acre per year in Kansas—21 percent—compares favorably to Michigan—29 percent (Schmidt *et al.* 1997)—and Minnesota—22 percent (Leatherberry *et al. 1995*).

In Kansas, potential productivity increases from west to east and from north to south.

Potential productivity was lowest in the Western Unit; only 14 percent of the timberland had a potential productivity of more than 85 cubic feet per acre per year. In the Northeastern Unit, 21 percent of the timberland had a potential productivity of more than 85 cubic feet per acre per year. And, in the Southeastern Unit, 25 percent of the timberland had a potential productivity of more than 85 cubic feet per acre per year. The Southeastern Unit contained the most productive timberland. In fact, nearly all of the timberland with the highest potential productivity (more than 165 cubic feet of growth per acre per year) was located there, which is indicative of the more productive forest soils and longer growing season in that portion of the State.

Increased Stocking Would Improve Productivity

Although the soils of Kansas are highly productive, their maximum capacity for growing trees is not always realized because stands are not always well stocked. Stocking, a measure of how well occupied the land is by trees, is typically measured by basal area. If timberland is held for wood fiber production, maximum production is gained from fully stocked stands. In 1994, slightly more than half (52 percent or 771 thousand acres) of the timberland in Kansas was either moderately or fully stocked. The other half was estimated to be poorly stocked (42 percent) or nonstocked (6 percent).

The volume of wood fiber grown in Kansas can be increased by improving the stocking levels on the more than 700 thousand acres of timberland that in 1994 were either nonstocked or poorly stocked. This is an important option because it is unlikely that timberland area will increase significantly in the future because of urban and agricultural expansion in eastern Kansas. Improving stocking and managing land to grow high-value species, such as white oak *(Quercus alba)*, northern red oak *(Q. rubra)*, and black walnut, can increase landowners' income and provide economic gain for communities.

TIMBERLAND VOLUME

Volume is presented for both growing stock and sawtimber. Growing-stock volume is the volume of wood on timberland in growing-stock trees at least 5 inches d.b.h., from 1 foot above the ground to a top diameter of 4 inches, less rot or other defects that reduce the yield for forest products. Sawtimber volume is a subset of growing-stock volume and is the volume of wood on timberland in trees from the stump to a minimum 9 inches top diameter outside bark (d.o.b.) for softwoods and 11 inches d.o.b. for hardwood species.

Growing-Stock Volume Made Big Gain

The volume of growing stock on timberland in Kansas increased from 877 million cubic feet in 1981 to 1,255 million in 1994, an increase of 43 percent. Almost three-fourths of the growing-stock volume is contained in six species or species groups—cottonwood, hackberry, white oaks, red oaks, ashes *(Fraxinus)*, and black walnut. Virtually all volume is in hardwoods (fig. 8). Eastern redcedar, the only softwood species, accounted for only 1 percent (17 million cubic feet) of the State's growing-stock volume.

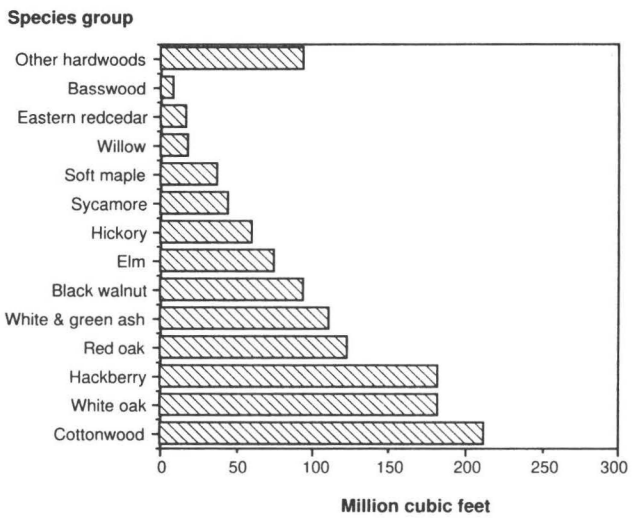

Figure 8.—*Growing-stock volume by species group, Kansas, 1994.*

Over the 13-year period between inventories, growing-stock volume averaged an increase of more than 29 million cubic feet per year. Nearly all species in the State had gains of more than 10 percent in growing-stock volume between inventories. Some had even more substantial increases. For example, the growing-stock volume of eastern redcedar, although only a small portion of total growing-stock volume, increased by 228 percent, from

5 to nearly 17 million cubic feet. Black walnut, an economically valuable species, experienced a 36 percent increase in growing-stock volume between inventories (despite the overall decrease in total number of black walnut trees). Only hard maple and river birch—both minor species in Kanses—declined in growing-stock volume.

Most of the increase in growing-stock volume is the result of an increase in the size of the average tree. The effect of increased tree size is especially noteworthy in the case of cottonwoods. For example, between inventories, the number of cottonwood trees declined by more than 3 million. However, as the number of trees declined, more volume was being added to the larger trees, especially those trees 21 inches d.b.h. and larger. To illustrate, in 1981, 50 percent of the cottonwood volume was in trees 21 inches d.b.h. and larger. In 1994, volume in trees 21 inches d.b.h. and larger had increased to 59 percent of the cottonwood volume. The situation was different for eastern redcedar. Because of the rapid expansion of the species, most of the increase in growing-stock volume was in smaller diameter trees. For example, in 1981, 67 percent of the total eastern redcedar growing-stock volume was in trees smaller than 11 inches d.b.h. In 1994, volume in trees smaller than 11 inches d.b.h. had increased to 81 percent of the total eastern redcedar growing-stock volume.

Average Volume Per Acre Increased

In 1981, the average growing-stock volume per acre on timberland in Kansas was 723 cubic feet. By 1994, it had increased to 842 cubic feet, a 16-percent gain. The cottonwood forest type had the greatest average growing-stock volume per acre in 1994 with 1,822 cubic feet, followed by elm-ash-cottonwood (1,050 cubic feet), bur oak (943 cubic feet), and lowland plains hardwoods (892 cubic feet). Forest types with the lowest volumes per acre were willow (329 cubic feet), eastern redcedar-hardwood (316 cubic feet), and eastern redcedar (251 cubic feet), all types common on less productive sites.

Sawtimber Volume

Total sawtimber volume increased from 3.1 billion board feet in 1981 to 4.4 billion board feet in 1994, a 43-percent gain. The same species that dominated in terms of growing-stock volume also dominated in terms of sawtimber volume, with cottonwood accounting for 23 percent (1 billion board feet) of all sawtimber volume in Kansas. Every species except basswood, river birch, and hard maple gained significantly in sawtimber volume. In addition to the sawtimber volume, there was a significant board foot volume represented in short-log trees in 1994—652 million board feet. Short-log trees meet local merchantability standards of one or more 8- to 11-foot saw logs, but not the national standard of a 12-foot log.

Sawtimber Quality

Sawtimber tree quality was assessed by the field staff as they assigned a log grade to softwood sawtimber-size trees and a tree grade to hardwood sawtimber-size trees on about one-third of the sampled plots. The four grades used were based on tree diameter and the presence or absence of knots, decay, crookedness of the bole, or other external characteristics in the lowest log of the tree. The relative amounts of these characteristics reflect the quality of the tree for manufacturing into high-quality wood products. The most critical element in determining log grade or tree grade is the d.b.h. of the tree. Smaller diameter trees tend to be assigned to the lower grades. Using sawtimber quality data, grade 1 represents the highest quality and grade 4 the lowest quality.

In 1994, Kansas had 29 percent of all its sawtimber graded as grade 1, 29 percent as grade 2, 32 percent as grade 3, and 10 percent as grade 4. Virtually all of the State's sawtimber volume is in hardwood species. The proportion of sawtimber volume that is in grades 1 and 2 points out the high quality of lumber produced in Kansas. This is clearly true for black walnut and select white oak, species that are in high demand. In 1994, 61 percent of the black walnut sawtimber volume was in grades 1 and 2. Fifty-five percent of the select white oak sawtimber volume was in grades 1 and 2. The high quality of the State's sawtimber is also reflected in increased veneer log production. Between 1980 and 1993, veneer log production increased by nearly 75 percent to 937 thousand board feet (Blyth *et al.* 1984, Hackett and Strickler 1996). Black

walnut and white oak accounted for most of the increase in veneer log production (Hackett and Strickler 1996).

Softwoods accounted for only 1 percent (31 million board feet) of sawtimber volume, and all of that was eastern redcedar. All eastern redcedar sawtimber volume was grade 3. Although eastern redcedar is graded low, the market for redcedar logs is expanding, and grade (number of knots) is generally not a factor in marketing redcedar.

Non-Growing Stock Volume

In a typical forest stand, trees are in varying stages of growth or development. Generally, most of the stand is well developed and growing vigorously. However, some trees are dead or dying, some have rot, some have defects because of roughness or poor form, and some are too short for commercial lumber. The volume of wood in such trees is referred to as non-growing stock volume. The tabulation below shows the volume of wood in non-growing stock trees in Kansas in 1994:

Tree form	Non-growing stock volume (Thousand cubic feet)
Short-log trees	168.8
Rough trees	456.8
Rotten trees	78.6
Salvable dead trees	59.5
Total	763.7

Non-growing stock trees are an important resource because they provide fuelwood, and wood for pallets and fence posts. As previously noted, short-log trees already meet the local merchantability standards and add a significant amount to the available board foot volume. In the future, commercial use of these trees will probably increase as the technology for using short sections of trees is more widely accepted. Non-growing stock trees also provide important noncommercial benefits. Many of those trees are preferred habitat for cavity nesting birds such as the hairy woodpecker *(Dendrocopos villosus)*, raccoon *(Procyon lotor)*, and the eastern fox squirrel *(Sciurus niger)*.

FACTORS ASSOCIATED WITH CHANGE IN TIMBERLAND

Many factors influence the composition and structure of timberland. In the past, wildfire was an important agent of change. More recently, human-induced changes have altered the forest landscape in Kansas. An analysis of the effect of disturbance on community composition, successional processes, and change in growth, mortality, and removals provides information about change in the timberland resources of Kansas. Change factors are discussed separately even though they are synchronous and interrelated.

Disturbance and Succession

Succession, the process of one plant community gradually supplanting another, is a powerful force of change in Kansas. Tree species succession takes place when pioneer species or early-successional species, such as eastern redcedar, honeylocust, Osage-orange, cottonwood, and elm become established following natural or human-caused disturbances. Two early-successional species—cottonwood and eastern redcedar—illustrate the effects of disturbance on community composition in Kansas.

Over the past 50 or so years in Kansas, cottonwood, an early-successional species, has been slow to regenerate. The massive reengineering of riparian environments from the expansion of agriculture, and construction of dams and stream channelization have contributed to altering the environment where cottonwood previously flourished. For example, dams and channelization reduce flooding, resulting in less scouring along stream banks and adjacent riparian areas. Cottonwoods need disturbed soil to regenerate, and scouring creates excellent seedbed sites. With reduced scouring, cottonwood regeneration slows. Further, cottonwood seeds require full sunlight to germinate, and in existing stands other species in the understory have slowly replaced the cottonwoods. Between 1981 and 1994, the number of cottonwood trees declined by 37 percent, from 8.6 million to 5.4 million trees. The decline of cottonwoods is common in the other Great Plains States as well. For instance, recent inventories of North Dakota (Haugen *et al.* in prep.) and Nebraska (Schmidt and Wardle 1998) reveal statewide declines in area of the cottonwood forest type.

Unlike cottonwoods, eastern redcedar trees have been especially successful as early invaders on grasslands and abandoned range and farmlands. Perhaps the most vivid illustration of the rapid increase of the species is the increase in the number of eastern redcedar trees between the two most recent inventories. In 1981, there were 8.5 million eastern redcedar trees in Kansas. By 1994, the number of eastern redcedar trees had increased to 28.1 million. The area of eastern redcedar expanded in Kansas largely because of changes in the agricultural sector of the economy. Between 1980 and 1993, the number of farms in Kansas declined by 10 thousand (U.S. Department of Agriculture 1994). Most of those farms were consolidated into larger holdings. At the same time, farmers and ranchers began to rely less on pastures and more on feedlots to support livestock. Between 1989 and 1993, for instance, the number of registered cattle feedlots in Kansas increased from 1,900 to 2,400 (U.S. Department of Agriculture 1994). Reduced tillage and the abandonment of pastures allowed eastern redcedar to expand into former agricultural lands. Birds and other wildlife were important vectors in the dispersal of seeds. The active suppression of wildfires also benefited eastern redcedar since a single fire can kill redcedar because the thin bark offers little protection from the heat. The expansion of eastern redcedar in Kansas follows the pattern set in other States in the lower Midwest (Schmidt and Leatherberry 1995).

In general, mid- to late-successional communities in Kansas, such as those associated with the red oak-white oak-hickory forest type, have remained stable. Species in that type have not been greatly affected because they tend to fully occupy and dominate sites. They can effectively resist the invasion of other species. Also, in those types, the predominant harvesting technique is selective cutting, which does little to change successional stage. However, the long-term stability of the red oak-white oak-hickory forest type bears watching because the area of sapling-seedling declined by almost 30 thousand acres between 1981 and 1994.

Growth

Growth is an important consideration when discussing changes in forests because it is an indication of not only the change in the volume of wood but also the health, vigor, and stage of development of stands. Growth is expressed as average annual growth and current growth for both growing stock and sawtimber.

Current growth is useful for comparing growth during two distinct years, but neither of the 2 years may represent average conditions. Net growth may fluctuate from year to year because of weather changes or catastrophic mortality. Net growth averaged over the period between the two most recent inventories (periodic growth) will even out these fluctuations and therefore may provide a more useful comparison. For the 1994 inventory, average annual growth is based on the average growth rate between 1981 and 1993, and current growth is based on growth in 1993. In the tables, both average annual and current growth are net growth. Net growth is gross growth minus mortality.

Between 1981 and 1993, an average of 25.8 million cubic feet of net growth of growing stock was added each year to timberland stands. The average annual growth rate in Kansas is 2.1 percent of the State's growing-stock inventory. Growing-stock current net growth was 21.9 million cubic feet in 1981 and 27.6 million cubic feet in 1993. This represents an increase of more than 26 percent between 1981 and 1993. The difference between 1993 current growth and average annual growth indicates that Kansas timberland is currently experiencing increasing growth. The increase in growing-stock volume can also be seen in the change in growing-stock volume per acre between inventories. In 1981, each acre of timberland in Kansas had an average of 723 cubic feet of growing-stock volume. By 1993, average growing-stock volume per acre had increased to 842 cubic feet.

Between 1981 and 1993, nearly half of the State's total net annual growth in growing stock was in hackberry (27 percent) and the oaks (20 percent). The growth rate for those species is significant because they accounted for only 39 percent of the net volume of growing stock on timberland in 1994. Cottonwood trees accounted for 17 percent of net volume of growing stock on timberland in 1994, but only 6 percent of the net annual growth between 1981 and 1993. This finding is further

evidence that cottonwood stands are not regenerating at a vigorous rate. Eastern redcedar expansion is indicated in growth rates for the species. Eastern redcedar accounted for less than 1 percent of the net volume of growing stock in 1981, but, 4 percent of the average net annual growth between 1981 and 1993.

Average annual net growth as a percent of the total volume differed by Survey Unit. Both the Northeastern and Southeastern Units averaged a net growth rate of about 2.3 percent of growing-stock volume compared to the Western Unit's average of only 0.8 percent of the Unit's total growing-stock volume. This reflects the more restrictive environment for trees found in western Kansas compared to eastern Kansas.

In 1994, sawtimber current annual net growth was 116 million board feet, 31 percent greater than the 1981 growth of 88.6 million board feet. (Note: sawtimber growth is a component of growing-stock growth.) Sawtimber average annual net growth for the period between inventories was 91.5 million board feet. On a per acre basis, Kansas timberland grew about 61 board feet each year between inventories. Sawtimber growth rates differed by Survey Unit—highest in the Northeastern Unit with an average 69 board feet per acre per year, followed by the Southeastern Unit at 62 board feet, and the Western Unit at 43 board feet. Some may consider sawtimber growth rates to be low. Consider, for example, that in Michigan, on a per acre basis, timberland grew about 145 board feet each year between inventories. The lower rate in Kansas is due to a number of factors, including climate, low stand stocking levels, and the impact of certain agriculture practices. In particular, the agricultural practice of spraying herbicides to control unwanted vegetation in cropland and pasture can affect the growth of trees if drifting occurs. In some areas, herbicide drift has caused crown damage to trees adjacent to fields and pastures.

We pointed out earlier that timberland in Kansas has the potential of growing more wood volume if stocking levels were improved. To get an idea of how much additional volume of wood timberland in Kansas might produce, we estimated the potential annual net growth on timberland based on the potential annual volume of growth per acre of fully stocked natural stands at culmination of mean annual increment in each potential productivity class. We multiplied the area in each productivity class by the midpoint of the range of growth in that class. Spurr and Vaux (1976) discounted an estimate of potential growth by 10 percent to adjust for the differences between actual stand conditions and the fully stocked, natural conditions implicit in use of potential productivity data. Thus, we discounted the potential productivity data by 10 percent to more accurately reflect current stand conditions in Kansas in 1994. Potential net annual growth for Kansas is estimated to be 84.5 million cubic feet per acre (table A).

Table A.—*Estimation of potential annual net growth on timberland, Kansas, 1994*

Potential productivity class (Cubic ft/acre/year)	Timberland area	Potential net growth per acre	Unadjusted total potential growth	Adjusted total potential growth (discounted 10%)
	Thousand acres	*Cubic ft/ acre/year*	*—Thousand cubic feet/year—*	
165 +	5.6	194.5	1,089.2	980.3
120-164	56.7	142.0	8,051.4	7,246.3
85-119	256.2	102.0	26,132.4	23,519.2
50-84	558.6	67.0	37,426.2	33,683.6
20-49	614.6	34.5	21,203.7	19,083.3
	1,491.7		93,902.9	84,512.7

Kansas has the potential to increase its net growth of growing stock by 228 percent based on an average annual net growth of 25.8 million cubic feet and a potential annual net growth of 84.5 million cubic feet. Among the advantages of increasing net growth is that no additional acres of timberland are needed to increase the volume of wood. This is important because with an increase in human population and the attendant urban expansion, and the desire to protect land from timber harvest, the potential to increase wood production by expanding timberland acreage will be limited. Obviously, the most efficient method of increasing wood production is through more intensive management of existing timberland. In addition, increasing wood production on existing timberland is likely to result in increased land value. If increased income from timberland is realized, owners are more likely to keep the land in trees and not convert to other uses.

Mortality

Between the two most recent inventories, mortality played a role in changing the timberland resource. Annual mortality of growing stock increased from 13.9 million cubic feet in calendar year 1981 to 23.6 million cubic feet in 1993, a 69-percent gain. During the period 1981 to 1994, growing-stock mortality averaged nearly 20.2 million cubic feet. Sawtimber annual mortality amounted to 45.4 million board feet in calendar year 1981, and increased to 93.5 million board feet in 1993, a more than 100-percent gain.

Mortality rates for growing-stock volume increased between inventories, going from 1.6 percent of inventory in 1981 to 1.9 percent in 1993. The sawtimber mortality rate increased from 1.5 percent of inventory in 1981 to 2.1 percent in 1993. Many known causes of mortality were found during the inventory; the three primary ones were stem decay, flooding, and foliage diseases.

The jump in mortality between inventories was due, in part, to mortality keeping pace with the increase in inventory of timber as trees added volume and advanced in age. For example, stem decay—decay in the central stem of trees—accounted for 12 percent (2.5 million cubic feet) of growing-stock mortality. Some mortality was caused by the massive flooding of bottom lands in eastern Kansas during the summer of 1993. Some areas in that part of the State were under water for several weeks. Flooding was the primary cause of growing-stock mortality for about 5 percent (997 thousand cubic feet) of the average annual mortality of growing-stock. Cottonwood trees were especially hard hit by flooding, accounting for over half the average annual growing-stock mortality caused by flooding. Mortality will probably increase in stands that were flooded because trees that experience prolonged periods in floodwaters exhibit symptoms of stress such as leaf yellowing, premature leaf drop, and dieback. These trees weaken and may be predisposed to lethal attacks by other agents. Approximately 3 percent of growing-stock mortality was caused by foliage diseases. Of special concern is mortality due to foliage diseases caused by the wet weather on walnut trees. Walnut anthracnose, or leaf blotch as it is sometimes called, is a destructive disease of black walnut. The disease may become epidemic during wet weather in the growing season. It causes premature defoliation and slows the trees' growth. Where premature defoliation occurs over a period of years, the stressed trees may die (Berry 1981).

Herbicide damage to timberland, windbreaks, and other tree plantings is a problem in Kansas and sometimes leads to tree mortality. Herbicide damage is not surprising given the interspersion of the forest with croplands and pastures. In some areas of eastern Kansas, oak wilt is slowly spreading. Dutch elm disease, however, is still perhaps the major tree mortality problem in Kansas. Nearly 120 thousand cubic feet of mortality of growing-stock volume is lost annually to Dutch elm disease. Elm had the highest growing-stock mortality rate among species—16 percent of its inventory—followed by willow (3.8 percent), select hickory (3.2 percent), and other red oak (2.6 percent).

Removals

In calendar year 1980, current removals from growing stock totaled 14 million cubic feet. In calendar year 1993, current removals from growing stock totaled 6.6 million cubic feet, a 53-percent decline from calendar year 1980. The rather steep drop in removals over the 13-year period between inventories suggests a prolonged decline in growing-stock removals. However, timber removals fluctuate from year

to year, depending on a host of economic and weather factors. Therefore, one way of assessing removals, besides observing figures for single years representing two points in time, is to compare average annual removals between inventories. This method permits a means of leveling the peaks and valleys of demand between years. With this approach, average annual timber removals from growing-stock volume amounted to 8.1 million cubic feet during the period 1981 to 1993. Only a small volume of softwood growing-stock volume was removed since hardwood removals amounted to nearly 8 million cubic feet, or 99 percent of the average annual removals. Total current annual removals for 1993 (6.6 million cubic feet) were less than total average annual removals for 1981 to 1993 (8.1 million cubic feet). The lower 1993 removals reflects the impact of massive regional flooding on harvest levels.

Three species accounted for about half of the 8.1 million cubic feet average annual removals of growing stock in Kansas. Average annual growing-stock removals of more than 1 million cubic feet per year on timberland occurred in oaks (1.5 million cubic feet), cottonwood (1.3 million cubic feet), and black walnut (1.0 million cubic feet).

Average annual removals of sawtimber (30 million board feet) as a percent of average annual growth (91.5 million board feet) in Kansas was 33 percent. Sawtimber removal differed by Survey Unit. The Northeastern Unit accounted for more than half (58 percent) of the average annual removals of sawtimber, followed by the Southeastern Unit (25 percent) and the Western Unit (17 percent). On a regional basis, the highest rate of sawtimber removals was in the Western Unit where average annual removals as a percent of average annual growth was 49 percent, followed by 43 percent in the Northeastern Unit, and 18 percent in the Southeastern Unit.

Relation Between Growth, Removal, and Mortality

Average annual net growth of growing stock on timberland in Kansas amounted to 25.8 million cubic feet. In terms of sawtimber volume, average annual net growth was 91.5 million board feet between 1981 and 1993 (fig. 9). Annual mortality averaged 20.2 million cubic feet for growing-stock and 60.5 million board feet for sawtimber. In addition, 8.1 million cubic feet of growing stock, including 30.0 million board feet of sawtimber, were removed from timberland annually between 1981 and 1993. The net increase in volume (gross growth minus mortality and removals) in Kansas averaged 17.7 million cubic feet of growing stock, including 61.5 million board feet of sawtimber each year between 1981 and 1993. On an average per acre basis, there was a net increase (gross growth minus mortality and removals) of about 12 cubic feet of growing stock per acre per year on timberland in Kansas.

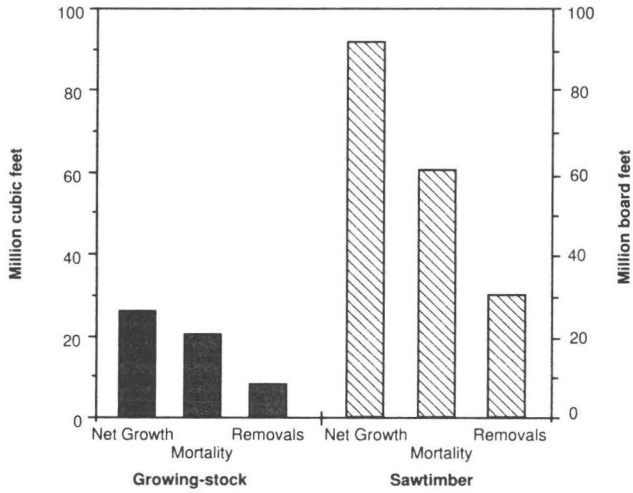

Figure 9.—*Average annual growth, mortality, and removals of growing stock and sawtimber on timberland in Kansas between 1981 and 1993.*

On an annual basis, timberland in Kansas is growing wood fiber at a rate—17 cubic feet of net growth per acre per year—that is comparable to the other States in the region. For example, in the most recent Nebraska (Schmidt and Wardle 1998) and North Dakota (Haugen *et al.* in prep.) inventories, average net growth per acre per year was about 18 and 17 cubic feet, respectively. However, average annual mortality increased. Average annual removals, on the other hand, declined between 1981 and 1993, and was about a third of average net growth at 8.1 million cubic feet.

FOREST PRODUCTS PROVIDE ECONOMIC BENEFITS

This discussion will focus on the status of the forest products industry in Kansas around 1994, the period that corresponds with the completion date of the most recent Kansas forest inventory. Information is presented to highlight the relative importance of the forest products industry in Kansas and is not intended to be definitive. The discussion related to roundwood production is based on information from a survey of Kansas wood using mills. See Hackett and Strickler (1996) for a more detailed discussion of timber product output and use in Kansas.

In 1993, there were 36 mills in Kansas receiving roundwood for processing into products such as lumber and veneer. All but six of the mills are located in eastern Kansas, close to the resource and potential markets. The primary wood-using mills in Kansas processed nearly 2.2 million cubic feet of roundwood into lumber and other products in 1993. Industrial roundwood products in Kansas include saw logs and veneer logs. Saw-log production was 12.5 million board feet in 1993, a drop of 60 percent from 1980. A contributing factor to lower production was the massive and prolonged flooding during the summer of 1993 that created unfavorable logging conditions and made it difficult for mills to maintain log inventories. More than 87 percent of the saw-log production was processed in Kansas. Of the saw-log production, nearly 2 million board feet were exported, primarily to Missouri and Iowa. Kansas mills imported 1.9 million board feet of logs, mostly from Missouri. However, logs coming into Kansas had high value added potential because more than 80 percent of the imported volume was black walnut. Most veneer log production in Kansas in 1993 was from black walnut and white oak logs. However, most veneer logs harvested in Kansas were exported overseas or shipped to Missouri. The export of veneer logs to foreign markets and other States removes the opportunity for Kansas to benefit from producing quality value-added wood products. However, the production of veneer logs provides an important source of income for landowners and supports a small but important sawmill industry that provides world and domestic markets with high-quality logs.

Although much of the high-valued timber from Kansas is exported, enough wood is imported for the State to have a vital and economically important forest products industry. According to the U.S. Department of Commerce, Bureau of Census (1995), manufacturing establishments in the lumber and wood industries (Standard Industrial Classification Code 24) employed 3,215 people, and paid $64.5 million in wages and salaries. The American Forest and Paper Association (1997) estimated that 4 percent of the manufacturing workers in Kansas in 1994 were employed in the paper and wood products sector of the economy. The payroll in the paper and wood products sector amounted to about 4 percent of income received from manufacturing employment in the State (American Forest and Paper Association 1997).

FORESTS PROVIDE MANY NONTIMBER BENEFITS AND VALUES

In addition to the direct economic benefits provided by the forest products industry, the people of Kansas benefit from the presence of forest lands and trees in a number of other ways. In this section, we discuss some of forest land's benefits and values that are not related directly to the forest products industry. Much of the evidence is anecdotal, and the discussion is intended only to illustrate some of the nontimber benefits and values trees and forest land provide in Kansas.

Forests Provide Fuelwood

More than one-fourth of the households in Kansas burned wood in 1994, consuming about 368 thousand cords. In addition, more than 21 thousand households planned to install wood-burning facilities. Wood is burned for heating homes, primarily as a secondary source of heat, but in the larger cities most people burn wood for pleasure. Burning wood for heat or for pleasure is not the only benefit derived from fuelwood. Apparently, some residents enjoy cutting their own wood since about half of the wood-burning households cut all or part of the fuelwood they burned. The most commonly used species were Osage-orange, oak, elm, and cottonwood (May 1996).

Forests Reduce Water Pollution

There are 12 major river basins and more than 134,000 miles of streams in Kansas. In total, water covers an estimated 459 square miles of the State. Unfortunately, many of the rivers and streams of Kansas have been affected by contaminants from agricultural operations and urban runoff. Forest land and wooded strips play an important role in limiting the effects of contaminants on water quality. Trees and associated vegetation in riparian areas act as filter strips, filtering out many contaminants before they wash into rivers, streams, and lakes. For example, in well-developed riparian areas, typically those 90 to 150 feet in width, vegetation has reduced nitrogen in ground water by 50 to 100 percent and in surface runoff by 78 to 98 percent (Lowrance 1992). The capacity of riparian areas to immobilize and remove nutrients before they enter surface water courses may also increase tree growth and enhance fish and wildlife habitat.

Sediment or eroded soil is another major cause of water pollution in Kansas with a number of major consequences. For example, sediment buildup in navigable rivers and lakes increases dredging requirements and shortens the life of reservoirs. Also, turbidity and siltation reduce the recreation potential of streams by destroying fish habitat and reducing the aesthetic quality. Trees, however, reduce siltation and sediment production because roots hold the soil in place and reduce bank sloughing. Trees and associated vegetation also intercept suspended particles in runoff before they reach watercourses.

Forests Reduce Soil Erosion

Because of its soils, Kansas enjoys a vital and productive agricultural economy. However, dry land agriculture, combined with Kansas weather, can cause soil erosion. Consider, for example, the "Dust Bowl" days when periods of drought and intense winds produced critical erosion hazards that led to massive soil losses and reduced soil fertility. We now know that trees, in the form of windbreaks and wooded strips, are an effective vegetative management tool that reduce soil erosion. Windbreaks reduce soil erosion by slowing down the wind as it passes over a field. The benefits of windbreaks extend leeward for a distance of at least 10 times the height of the trees (Wardle and Schmidt 1984). In Kansas, there are nearly 220 thousand acres of windbreaks that protect millions of acres of cropland from wind erosion.

In 1994, Kansas had 265 thousand acres of wooded strips that reduced soil erosion. Wooded strips are often found adjacent to rivers and streams. Those areas are wooded primarily because they are either too steep or too wet for farming and are susceptible to erosion. If undisturbed, wooded strips protect the soil from erosion. In undisturbed and well-managed forest land in the Eastern United States, the soil has an average erosion rate of 0.05 to 0.1 tons per acre per year (Patric 1976). Forest soils are generally highly permeable and have high absorption rates (Hewlett and Hibbert 1967, Rice *et al.* 1972) minimizing the amount of water runoff and sediments entering the river or stream. Alluvial deposits improve the future potential production of streamside sites.

Forests Provide Wildlife Habitat

The diverse forest resources of Kansas provide critical habitat for many wildlife species. Wildlife plays a major role in the quality of life by providing hunting and fishing opportunities; observation and photography opportunities; and the satisfaction of just knowing wildlife is present. Fortunately, Kansas is blessed with many different wildlife species. There are approximately 86 species of mammals in the State, 32 of which are associated with forest habitats. The State is home to 425 bird species as residents during all or part of the year, with 115 requiring forested habitat for part or all of their life cycle. Statewide, there are 30 species of amphibians and 67 reptiles that rely on forest habitat (Collins *et al.* 1995).

Wildlife species dependent upon the forests are a vital ingredient of the forest ecosystem. The population size of many species is directly related to the amount and kind of woody vegetation available to them. Wildlife populations within an area often will increase in conjunction with increases in the acreage of woody vegetation and, correspondingly, decline with a decrease in woody vegetation. For instance, many trees found in the red oak-white oak-hickory forest type—a major component of the Kansas forest—are also mast producers. Wild turkey *(Meleagris gallopavo)*,

squirrels (mostly Eastern gray squirrels—*Sciurus carolinensis)*, and other woodland-dependent species are found in abundant numbers in areas where this forest type predominates. Green ash trees offer valuable cover, forage, and habitat diversity for wildlife, particularly because of their floristic and structural composition, limited distribution, and island-like dispersion (Finch and Ruggiero 1993). In the winter, green ash stands are good breeding habitats for birds, small mammals, and white-tailed deer *(Odocoileus virginianus)*. Mature eastern redcedar provides winter cover for white-tailed deer. More than 17 thousand acres of redcedar and 33 thousand acres of redcedar-hardwood forest type in Kansas provide habitat for deer and food sources for birds.

Many other wildlife species in Kansas, while actually not forest dwellers, rely on forest/trees for their survival. For instance, cavity-nesting blue birds *(Sialia sialis)* prefer a mixture of open grassland and scattered trees and shrubs. They rely on dead or dying trees for nesting sites. Ring-necked pheasants *(Phasianus colchisus)* are normally associated with farmland in western and central Kansas, but abundant forest cover, as windbreaks, wooded strips, or woodlands, has a dramatic positive influence on their population during severe winter weather.

Forest land provides important habitat for rare or endangered species. In Kansas, several wildlife species associated with forest habitat are considered endangered or threatened by Federal or State agencies. Among these are the eastern spotted skunk *(Spilogale putorius)*, bald eagle *(Haliaeetus leucocephalus)*, northern spring peeper *(Hyla c. crucifer)* and broadhead skink *(Eumeces laticeps)* (Collins *et al.* 1995). For these and other species of wildlife, forest habitat is extremely important for their continued existence in Kansas.

Wildlife species are affected by forest management activities. For example, timber harvesting provides multiple benefits for the State's white-tailed deer. Timber harvest can provide more feeding territory and sets back the successional stages of forests. When hardwood forests reach poletimber size, the trees are not as available for food as sapling- and seedling-size trees and they shade out desirable food plants and shrubs. Kansas has almost 285 thousand acres of hardwoods in the sapling- and seedling-stand size, which serve as a valuable food source for white-tails. However, heavy deer browsing on tree seedlings can have a severe negative impact on the regeneration of some tree species. Also, deer in Kansas may have negative social and economic impacts, where populations reach levels that lead to crop damage and excessive deer-vehicle collisions.

Many birds depend on Kansas forests for nesting cavities, food, and shelter. Cavity-nesting species such as woodpeckers (Order *Picidue*) and owls (Order *Stigiformes)* need mature forests, while species such as brown thrashers *(Toxostoma rufum)* require open, younger forests. Bird communities in mature forests are distinct from those in early-successional stages. As the forest ages, bird species diversity increases because species associated with older forests colonize the area while species associated with younger forests maintain some presence.

Forests Provide Visual Diversity

Forest lands, windbreaks, and wooded strips occupy only 3 percent of the total land area of the State. However, they contribute significantly to visual diversity by providing a mosaic character to the landscape (fig. 10). In short, trees are a stark contrast to the prairie and plains. The early European settlers understood the value of trees on the prairie, and many planted trees in an effort to increase visual diversity (Sutton 1985). In rural areas, eastern redcedar was often planted around houses and other structures such as churches and schools. Osage-orange was often planted as hedges or fence rows. Today, many of those plantings now visually divide the landscape. According to Sutton (1985), those areas of trees form rectangular blocks or masses in the landscape that resemble remnants of a pre-existing forest. They also add a strong enclosure to the rural landscape and become frequent borders to roads. In some areas, natural succession has led to trees encroaching into nearby pastures and prairies. It should be pointed out however, that many of these invaders such as eastern redcedar, elm, and honeylocust are native to Kansas. Changes in land management practices—such as fire control and heavy grazing, combined with lack of vegetative management—have been significant factors in this increase in tree succession.

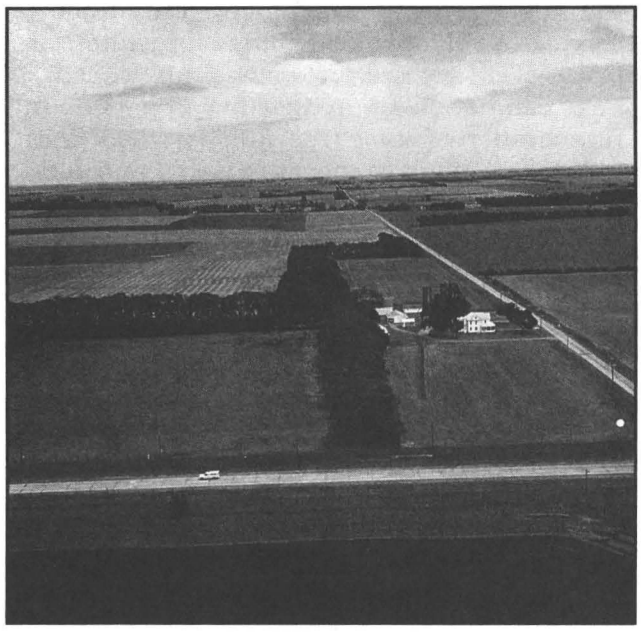

Figure 10.—*Windbreaks, trees planted in strips less than 120 feet wide, are used to protect soil, fields, and buildings, but also contribute significantly to biological and visual diversity.*

Forests Provide Outdoor Recreation Opportunity

Hunting is an important recreation activity that is dependent on forest land. Not only does hunting provide outdoor recreation, it also contributes to the economy of the State through the sale of licenses, equipment, and accommodations. Cotton-tail rabbit *(Sylvilagus floridanus)*, gray and fox squirrels, wild turkey, white-tailed deer, and wood duck *(Aix sponsa)* are forest-dependent species that are hunted as game. Hunting of white-tailed deer, the State's most important big game animal in terms of number of hunters and amount of economic activity, contributes significantly to the economy. For example, in 1994, more than 34 thousand deer were harvested, helping to generate about $44 million of expenditures from outdoor recreationists.

Wild turkey, a forest-related species, was virtually non-existent in the State during the first half of this century, but it has increased tremendously in population since then. The rebound of wild turkey populations is largely attributable to reintroduction efforts, involving trap and transplant operations. Today, wild turkeys are found throughout the State. Harvest levels have significantly increased from 530 birds in 1981 to more than 14,500 in 1994.

In Kansas, there are an estimated 241 thousand hunters. Leasing of land for hunting is an important source of income for some landowners, and lease hunting is likely to expand. A study of hunters in Kansas revealed that 35 percent of them approved lease hunting, and most believed they would not change their habits drastically should lease hunting become widespread (Maier and Karim 1987).

Kansas has 24 State parks covering about 33 thousand acres. In 1990, more than 4 million people visited Kansas State parks to participate in outdoor recreation activities such as camping, nature observation, picnicking, and canoeing. In addition, there are 24 federal reservoirs in Kansas. These reservoirs were constructed primarily for flood control and to store water, but they provide outdoor recreation opportunities for Kansas residents and visitors.

Forests Provide Special Products

Forests in Kansas produce a variety of specialty products, some that are not related to the harvesting of wood fiber. These products tend to be provided by a cottage industry and include edible nuts and mushrooms, decorative wood, and products made from bark. Walnut plantations, for example, produce nuts that are an important cash crop for some landowners. Native pecan *(Carya illinoensis)* trees, often found at the edge of fields or meadows or in groves can produce a cash crop of nuts if managed properly. Bark from cottonwood trees is used by professional wood carvers to carve faces and caricatures from the thick plates. It is also used for bases for floral arrangements and crafts (Jones 1997). Sticks of oak, hickory, and elm, with the bark attached, can be sold for the manufacturing of bent-wood or rustic furniture (Jones 1997). Eastern redcedar, a rapidly expanding species in Kansas, can be sold for furniture manufacturing, animal bedding, decorative boxes, chests, and liners for closets. Presently, it appears unlikely that large enterprises will develop from producing special products in Kansas. However, for

individual landowners, wood and related products sold for special products can be an important source of income and can provide seasonal or temporary employment.

TIMBER SUPPLY PROJECTIONS

We made two sets of 30-year projections of the State's supply of timber. These projections are done so that natural resource planners, policymakers, and others interested in forest resources will have information about the future outlook for timber in the United States. Kansas, with its comparatively small timber resource, will play a minor role in meeting the Nation's future demand-supply problems. However, the State will continue to be an important supplier of high-quality hardwood timber, especially black walnut logs. One of the projections (consistent removals option) assumes that growth and removals of timber will follow the same trend as occurred between the 1981 and 1994 inventories. Under this option, it is assumed that landowner attitudes and practices toward forest management for timber production will not change. The other projection assumes an accelerated level of timber removals (accelerated removals option). A third possible option where timber growth would decline was also considered. However, based on trends and the current condition of the forest resource in Kansas, we do not foresee a decline in timber growth as likely, barring some type of catastrophe in the future, or the possible onset of climate change brought about by factors such as the continued release of greenhouse gases that result in a rise of average annual temperatures for the Earth's surface.

Several assumptions apply to both the consistent and accelerated options. Assumptions used in making the projections are:

1. In both the consistent and accelerated removals options, the total area of timberland will stay about where it is presently. Over the period, it is expected that some timberland will go out of production because of increased urbanization in eastern Kansas, increased pressure to produce agricultural products from highly productive land, and the designation of some timberland as reserved forest land. Much of those losses will be off-set by the expansion of timberland into abandoned agriculture lands. A number of other factors are expected to contribute to a steady-state timberland base. Technological advances in agriculture that allow increased yields on a per acre basis will reduce pressure to convert timberland to agriculture. The reliance on feedlots for livestock production will also have the effect of preserving existing timberland. The high cost of land clearing, combined with less economic incentive to convert marginally productive land into agriculture, will not accelerate the clearing of timberland appreciably. Also, current government agriculture policies will likely remain in effect allowing marginal agricultural land, especially highly erodible land, to stay out of production. The economic value of owning timberland will probably increase because Kansas has the potential to produce high-quality hardwoods, and demand for such wood is expected to expand in the future. Recognition of other values for timberland will probably also increase.

2. The availability of timberland for harvest will remain the same as in the recent past.

3. For the consistent removals option projection, growth rates (2.2 percent of growing-stock inventory) will remain constant at the 1993 level throughout the projection period. For the accelerated removals option, growth rates will increase on a straight line from 2.2 percent in 1993 to 2.4 percent in 2024.

4. For the consistent removals option projection, removal rates (0.52 percent in 1993) will remain constant at the 1993 level. For the accelerated removals options, the removal rate will increase in a straight line to 1.55 percent in 2024.

5. There will be no major changes in the economic, social, or political structure.

Consistent Removals Option Projection

In the consistent removals option projection, growth increases from 27.7 to 45.8 million cubic feet between 1994 and 2024. Removal is less than growth but is projected to increase from 6.6 to 10.4 million cubic feet during the period. The difference between the growth and removals widens until by 2024 growth exceeds

removals by 35.4 million cubic feet (fig. 11). Total growing-stock volume rises from 1,255.3 million cubic feet in 1994 to 2,081.1 million cubic feet in 2024, a gain of 66 percent (fig. 12).

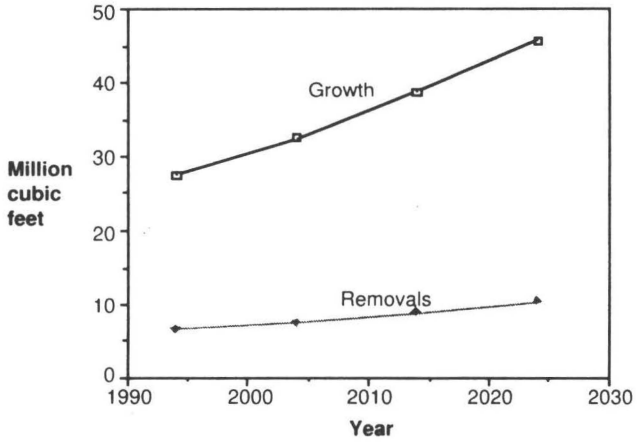

Figure 11.—*Net annual growth and removals from 1994 to 2024, consistent removals option projections, Kansas.*

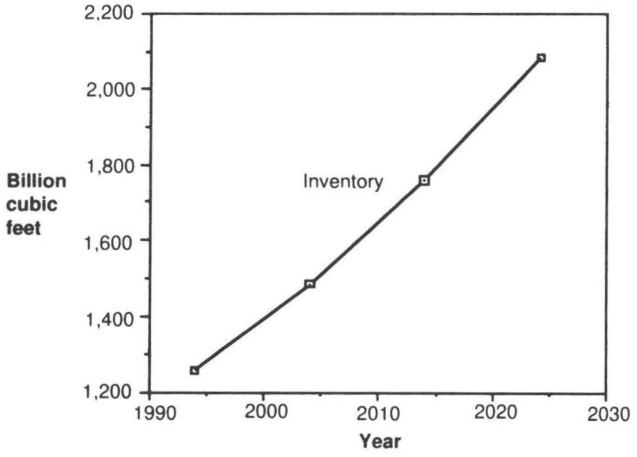

Figure 12.—*Inventory of growing stock on timberland from 1994 to 2024, consistent removals option projections, Kansas.*

Accelerated Removals Option Projection

In the accelerated removals projection, growth increases from 27.6 million cubic feet in 1993 to 43.2 million in 2024, a 36-percent gain. Removals increase from 6.6 to 28.4 million cubic feet during the same period, a 330-percent increase. Growth exceeds removals by 21 million cubic feet in 1994, but, the difference between the two drops to 14.7 million cubic feet by 2024 (fig. 13). Growing-stock inventory rises from 1,255.3 million cubic feet in 1994 to 1,832.4 million cubic feet in 2024 (fig. 14).

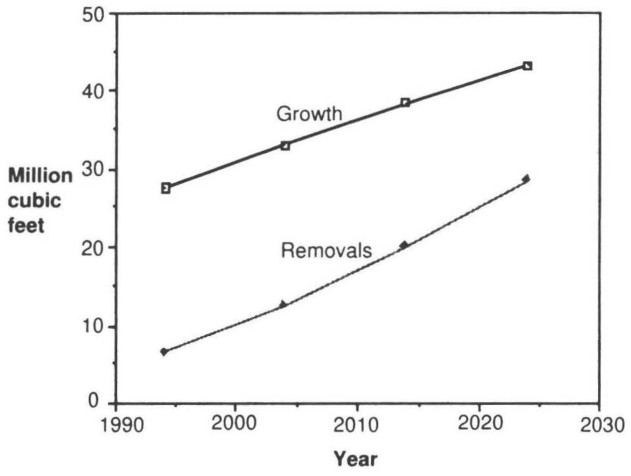

Figure 13.—*Net annual growth and removals from 1994 to 2024, accelerated removals option projections, Kansas.*

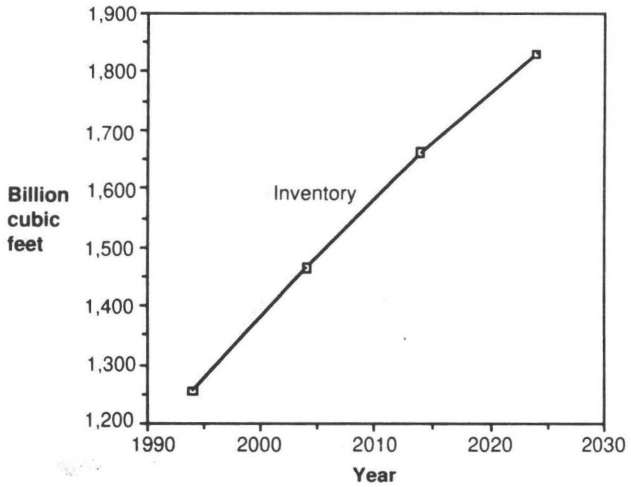

Figure 14.—*Inventory of growing stock on timberland from 1994 to 2024, accelerated removals option projections, Kansas.*

THE OUTLOOK

The projections represent what we believe the forest situation in Kansas will be over the next 30 years. However, the projections for the first 10 to 15 years are probably more dependable than those for later years because our ability to predict political, economic, and market conditions becomes less reliable as we go further into the future. Nonetheless, we believe the projections represent the high and low bounds within which the future forest will develop.

The projections are not intended to convey desirable goals from silvicultural, social, or economic perspectives. They are merely indicators of what is likely to happen if forests in Kansas are managed or kept much as they have been for the past 13 years and if harvesting or other removals occur at a "high" or a "low" level.

The total inventory of growing stock will continue to expand, as average tree size continues to increase, and as the volume of net growth continues to exceed the volume of removals. Inventories of individual species will differ in their rates of increase or decline based on their market demand, their growth rates, their place in the order of plant succession, their susceptibility to large-scale mortality, and other factors. Hardwoods will remain dominant as eastern redcedar continues to expand into abandoned pastures and fields. If markets for eastern redcedar improve, as they have in Missouri, the species could become more desirable and more intensely managed. Also, more intensive management of high-value species such as black walnut and white oak could result in higher growth rates and larger inventories than those projected.

The future area of the cottonwood type, which declined between 1981 and 1994 largely due to massive changes in riparian environments, is more difficult to predict. In 1994, about one-fourth of the State's growing-stock volume was in cottonwood trees. Cottonwood has been in high demand largely because it has been readily available. For example, in 1993, only the volume of black walnut harvested in Kansas exceeded the volume of cottonwood that was harvested (Hackett and Strickler 1996). Cottonwood is used mostly for lumber in building construction, and veneer and plywood for specialty products such as baskets and plywood core. For the near future, cottonwood will continue to be harvested, but cottonwood regeneration will probably continue to decline and the economic impact will be felt locally. However, the ecological consequence will probably be more profound.

Nearly all of the forest land in Kansas is privately owned. The various owners hold forest land for different reasons, and their motives differ in deciding how to use the land. The decision they make about their land will play an important role in sustaining the State's forest products and outdoor recreation industries, and in shaping the ecological character of the environment.

APPENDIX

RELIABILITY OF THE SURVEY

Forest Inventory and Analysis information is based on a sampling procedure designed to provide reliable statistics at the State and Survey Unit levels. Consequently, the reported figures are estimates only. A measure of reliability of these figures is given by sampling errors (see tabulation below). These sampling errors mean that the chances are two out of three that if a 100-percent inventory had been made, using the same methods, the results would have been within the limits indicated.

For example, the estimated growing-stock volume in Kansas in 1994, 1,255.3 million cubic feet, has a sampling error of ± 3.4 percent (± 43.7 million cubic feet). The growing-stock volume from a 100-percent inventory would be expected to fall between 1,299.0 million cubic feet and 1,211.6 million cubic feet (1,255.3 ± 43.7), there being a one in three chance that this is not the case.

Item	State totals	Sampling error
Growing stock	(Million cubic feet)	(Percent)
Volume (1994)	1,255.3	3.4
Average annual growth (1981-1993)	25.8	4.9
Average annual removals (1981-1993)	8.1	13.5
Sawtimber	(Million board feet)	
Volume (1994)	4,397.3	4.1
Average annual growth (1981-1993)	91.5	5.9
Average annual removals (1981-1993)	30.0	12.3
	(Thousand acres)	
Timberland area (1994)	1,491.7	2.2

As survey data are broken down into sections smaller than State totals, the sampling error increases. For example, the sampling error for timberland area in a particular county is higher than that for total timberland area in the State. To estimate sampling error for data smaller than State totals, use the following formula:

$$E = \frac{(SE)\sqrt{(\text{State total volume or area})}}{\sqrt{(\text{Volume or area smaller than State total})}}$$

Where :

E = Sampling error in percent.

SE = State total error for volume or area.

For example, to compute the error on the area of timberland in the elm-ash-locust type for the State, proceed as follows:

1. Total statewide area of elm-ash-locust type from table 3 = 478.8 thousand acres.
2. Total area for all timberland in Kansas from table 3 = 1,491.7 thousand acres.
3. Kansas total error for timberland area from table 56 = 2.2 percent.
4. Using the above formula:

$$E = \frac{(2.2)\sqrt{1{,}491.7}}{\sqrt{478.8}}$$

E = 3.9 percent sampling error for the elm-ash-locust forest type in Kansas. Sampling errors for area, volume, growth, and removals, for both growing stock and sawtimber, for counties and county groupings are shown in table 56.

COMPARING THE FOURTH INVENTORY OF KANSAS WITH THE THIRD INVENTORY

A new volume estimation procedure that was developed for the Central States was used to compute the 1994 volumes and to recompute the 1981 volume. Although the adjustment will differ by species, the recomputed 1981 growing-stock and sawtimber volumes will generally be greater than those shown in the 1981 report.

Past surveys used only growing-stock trees to determine stand-size class. Current survey procedures require that stand-size class be determined on the basis of all live trees. Therefore, direct comparisons of current inventory data to old inventory data by stand-size class may be misleading.

SURVEY PROCEDURES

The survey procedures used in this inventory are described in detail in Hansen (1998). A summary of these procedures is presented here. This summary consists of three parts:

1. A description of the statistical design used in the inventory, which deals with the methods used for stratification, aerial photo, and ground plot selection and estimation.

2. A description of the ground plot measurements that focuses on the plot design and changes in the design between the 1981 and 1994 inventories.

3. A description of the methods used to compute items presented in this report (area, number of trees, volume, growth, mortality, removals, and biomass) from field plot measurements.

STATISTICAL DESIGN

The basic design for this inventory consists of two independent samples that were combined to provide an overall estimate of the forest resources of Kansas. The first sample is based on the remeasurement of the 1981 NC-FIA inventory, and the second sample is based on the Natural Resources Conservation Service's National Resources Inventory (NRCS-NRI). These samples produce two independent estimates of the total forest resource in Kansas and were combined, using statistically appropriate methods, to provide the best overall estimates possible. The State of Kansas provided additional funding to NC-FIA to take additional field measurements in the Northeastern and Southeastern Survey Units in both the 1981 and 1994 inventories. The funding intensified the sample in eastern Kansas and resulted in lower sampling errors in that part of the State.

SAMPLE BASED ON THE REMEASUREMENT OF THE 1981 NC-FIA INVENTORY

The first sample was based on the remeasurement of aerial photo and ground plots taken during the 1981 NC-FIA inventory of Kansas. This inventory used double (two phase) sampling for stratification as presented in Cochran (1977) and Loetsch and Haller (1964). Aerial photo plots were observed in the first phase, and ground measurement or field plots were measured in the second phase.

1981 NC-FIA Inventory Aerial Photo Plots (Phase 1)

The first phase of the 1981 inventory was a systematic sample of aerial photo plots distributed over the entire State. Sampling was done using a grid at the intensity of 121 photo plots per township (6 miles by 6 miles). This gave a phase 1 sampling rate of one photo plot per 190.4 acres. Each photo sample plot was classified as *forest, nonforest with trees, nonforest without trees, questionable* (samples where the photo interpreter was unable to make a definite call between forest and nonforest), *unproductive, census water or noncensus water.* The distribution of photo plots by aerial photo classification in the 1981 NC-FIA forest inventory was:

Aerial photo classification	East	West
Forest	8,070	1,550
Questionable	296	118
Nonforest with trees	3,442	2,508
Nonforest without trees	83,642	174,863
Noncensus water	198	227
Census water	709	371
Total	96,357	179,637

1981 NC-FIA Inventory Ground Plots (Phase 2)

A systematic sample of the aerial photo plots was selected for ground plots in phase 2 of the 1981 inventory. A total of 17,291 ground plots were selected from the 275,990 photo plots. These ground plot locations were carefully examined stereoscopically, pin pricked on the aerial photo, and assigned a ground plot identification number. Ground plots that definitely were not forest land (those classified as nonforest without trees, noncensus water, or census water) were given a nonforest ground land use classification (more detailed than the photo classification done on all photo plots) by the photo interpreter and not sent to the field for measurement. These plots are referred to as office ground plots. Ground plot locations that could possibly be forest land (those classified as forest, questionable, or nonforest with trees) were sent to the field for ground classification. The average ground plot

sampling intensity was one ground plot per 1,440 acres in the Southeastern and Northeastern Units and one plot per 3,138 acres in the Western Unit. The distribution of ground plots by aerial photo classification in the 1981 NC-FIA inventory was:

Aerial photo classification	East	West
Forest	1,261	125
Questionable	82	15
Nonforest with trees	412	131
Nonforest without trees	10,906	10,592
Noncensus water	29	21
Census water	114	19
Total	12,804	10,903

Estimates of the forest resources presented in 1981 inventory reports are based on double sampling for stratification based on these six strata.

Remeasurement of the 1981 NC-FIA Inventory

The aerial photo classification completed in the 1981 inventory was used for stratification in the first sample of the 1994 Kansas forest resources. These 275,990 photo plots were used as the phase 1 sample to estimate the area in each of the six strata. The second phase used plots that were visited by field crews to sample and observe ground conditions (land use, volume, growth, mortality, removals, etc.) within the six strata.

The 1981 ground plots measured in the field form the second phase of this sample. In the forest, nonforest with trees, and questionable strata, remeasurement observations of every systematic ground plot location established during the 1981 inventory were used to estimate average ground conditions within each stratum in 1994. In the nonforest without trees, census water, and noncensus water strata, a cluster sampling scheme (using townships as clusters) was used to make repeated ground observations of the photo plots established in the 1981 inventory.

This sampling scheme was selected to improve our ability to estimate the area of forest, with particular emphasis on estimating the actual area of land change to and from forest. Because all stratification was based on the same photo classification used in the previous inventory, estimates of change in forest area cannot be biased by differences in the quality of the aerial photography, the equipment and techniques used, and the individual photo interpreters and their skills. This design maintained the same level of intensity as the previous inventory in the strata where we found most of the forest land in the 1981 inventory (the forest and questionable strata) and in those strata where we anticipated most of the additional forest land would come from (the nonforest with trees). The photo plots that were classified as nonforest without trees, census water, and noncensus water in the 1981 inventory were, by far, the largest portion of the 1981 photo sample. In addition, on a plot by plot basis, these strata were anticipated to have a low probability of currently being forest. Cluster sampling provided an efficient sample of this large area with a low probability of change, by examining a large number of locations at two points in time.

In the forest, questionable and nonforest with trees strata where double sampling was used, the ground plot sampling intensity was one plot per 1,454 acres in the eastern units and one plot per 2,737 acres in the west. In the nonforest without trees, noncensus water, and census water strata where cluster sampling was used in the east, 75 townships from the total 1,529 townships were sampled. The ground plot intensity in the east for the nonforest without tree strata was 3,236 acres per plot. In the west, 44 townships from the total 1,029 townships were sampled. The ground plot intensity in the west for nonforest without tree strata was 6,579 acres per plot.

Every ground plot in the 1994 inventory was classified for disturbance and other changes that may have taken place between 1981 and 1994. Disturbed plots are those that showed evidence of harvesting, insect or disease damage, land-use change, or other significant changes since the last inventory. A subset of the undisturbed forest ground plots were not remeasured. Instead, they were updated using the Stand and Tree Evaluation Modeling System (STEMS) (Belcher *et al.* 1982). The undisturbed forest plots that were remeasured were used to adjust the STEMS model for discrepancies between updated and actual remeasurements using methods presented in Hansen (1990) that have been used in the previous NC-FIA inventories in Michigan,

Minnesota, Iowa, Missouri, and Wisconsin. The undisturbed forest plots that were not remeasured are referred to as pseudo-remeasurement plots because they contain all the data normally collected on a remeasurement plot (new plot and tree level data) but without the expense of a field visit. This methodology has been very efficient in other States inventoried by NC-FIA. Not remeasuring these undisturbed forest plots made available the resources needed to establish additional ground plots for the second inventory based on NRCS-NRI.

SAMPLE BASED ON NRCS-NRI

Just before this inventory, the Natural Resources Conservation Service (NRCS) conducted its National Resources Inventory (NRI) in the Plains States (U.S. Department of Agriculture 1991) using a two-stage sampling design. This sample design consisted of 160-acre and 640-acre primary sampling units (PSU) with three 2-acre secondary sampling units (SSU) located within the PSU's. The NRCS-NRI inventory sampled all lands except those owned by the Federal government. Estimates of the 1994 forest resources on Federal lands (primarily Army Corps of Engineers, Bureau of Land Management, and Bureau of Indian Affairs lands) come entirely from the NC-FIA inventory described in the previous section. The data collected in the NRI formed the basis for stratification of the second independent inventory.

This second portion of the overall inventory of Kansas forest resources used the NRCS-NRI area estimates and point data as its basis for stratification and ground plot location in a double sampling scheme similar to the first inventory (the NC-FIA remeasurement of the 1981 field ground plots). The number of 2-acre SSU plots that were sampled by NRCS in the Kansas NRI were:

	East	West
Forest (20 percent tree cover or greater)	453	77
Nonforest (less than 20 percent tree cover)	6,659	13,255
Total	7,112	13,332

NC-FIA photo classified and installed standard NC-FIA ground plots at a subset of the NRI-SSU plot locations. In east Kansas, 5 percent of all SSU points and 50 percent of any SSU point with 20 percent or more tree cover were included in the NC-FIA sample. In the west, 10 percent of all SSU points and 100 percent of any SSU point with 20 percent or more tree cover were included in the NC-FIA sample. This subsampling formed the basis of the estimation of means within strata. The average sampling intensity in the forest stratum was one ground plot per 3,313 acres in the east, and one ground plot per 4,429 acres in the west. In the nonforest stratum, the sampling intensity was one ground plot per 28,397 acres in the east, and one ground plot per 22,895 acres in the west.

COMBINED ESTIMATE BASED ON THE TWO INDEPENDENT INVENTORIES

These two inventories produced two independent estimates of the forest resources in Kansas. Final estimates presented in this report are based on weighted averages from these two independent estimates. Weighting was proportional to the number of ground plots on forest land for the estimates of most items including area, number of trees, volume, growth, mortality, and biomass. Weighting based on the number of remeasurement plots on forest land was used for estimates of items that can only be obtained from remeasurement plots, including removals and area change over time.

Field Measurements: 1981 Inventory Plot Design

On plots classified as timberland, wooded pasture, or windbreak (at least 120 feet wide), a ground plot was established, remeasured, or the growth and mortality of its trees were predicted using the STEMS models. Old plots selected for remeasurement that could not be relocated were replaced with new plots at the approximate locations of the old plots. Each ground plot consisted of a cluster of 10 subplots collectively covering approximately 1 acre. Trees 5.0 inches or greater in d.b.h. were sampled using 37.5 basal area factor (BAF) variable-radius plots, and trees less than 5.0 inches d.b.h. were sampled on 6.8-foot radius (1/300-acre) microplots established at the center of subplots 1, 2, and 3. Under the estimation procedures used in this inventory,

an entire plot was represented by a single condition class where condition was determined by forest type, stand size class, land use, stand origin, and density. Thus, the arrangement of the 10 subplots within the plot was adjusted if any subplot were located in condition classes different from that of subplot 1. In particular, if a subplot was located outside the condition class of the plot, it was re-established or rotated into the condition class used for the entire plot. For example, if subplots 1 through 9 were located in forest land, and subplot 10 was located in a pasture, then subplot 10 was rotated back into the forest land condition class.

Field Measurements: 1994 Inventory Plot Design

Field ground plots were established, remeasured, or the growth and mortality of their trees were predicted using the STEMS models for forest lands, wooded pasture, or windbreaks (at least 120 feet wide). Establishing ground plots on all forest lands represented a major change between the 1981 and 1994 inventories.

In 1994, the overall plot layout consisted of 10 subplots arranged in a cluster with 70 feet between subplots. The basic locations of plots and subplots were the same as in the 1981 plot layout. All trees less than 5 inches in d.b.h. were measured on 6.8-foot radius (1/300th acre) microplots established at the centers of all 10 subplots. (In 1981, these microplots were measured only on subplots 1, 2, and 3). This radius was the maximum distance at which a 5.0-inch d.b.h. tree would be selected using a basal area factor (BAF) of 37.5. Trees with diameters between 5 and 17 inches were selected for measurement at each of the 10 subplots with a BAF of 37.5. All trees greater than 17 inches d.b.h. located within a 24-foot radius macro-subplot centered at each of the 10 subplots were selected for measurement.

In 1994, subplots of the same plot were not rotated, even if they were located in multiple condition classes or straddled condition classes. As in 1981, factors determining condition class were forest type, stand-size class, land use, stand origin, and density. Plots with multiple condition classes were mapped in the field to record how the boundaries between classes split the plot. This procedure identified the area of the plot located in each class and assigned each tree to a specific class. When multiple condition classes occurred on a plot, all information normally collected for the plot as a whole, such as forest type, site index, stand age, and stand-size class, was collected for each condition class.

On remeasured plots, the rotated subplots and all trees measured from the 1981 plot design were also remeasured in 1994 to obtain change data such as growth and mortality. On new plots, subplots were not rotated.

New Inventory Plots

New ground plots were selected from the plots identified in NC-FIA's evaluation of the NRCS-NRI inventory. These new ground plots were established, and measures of current classification such as land use, forest type, and ownership, as well as size and condition of all trees on the plot, were recorded. These locations were monumented for future remeasurement.

Old Inventory Plots

Old inventory plots are those plots established, monumented, and measured as part of the 1981 field inventory. The procedures for these old plots were different from those for new plots. Old plots were classified as "disturbed" on the basis of aerial photo analyses if either: (1) a reduction in vegetation on the plot occurred between inventories that resulted in a detectable change in the structure or function of the plant community; or (2) conditions on the plot were such that the STEMS models were unable to accurately predict growth or mortality. Plots not predicted to be disturbed were classified as "undisturbed." All disturbed plots, and a one-third sample of the undisturbed plots were remeasured to obtain estimates of current conditions and changes since the last inventory. All remaining live trees measured on these plots in 1981 were remeasured, and all new trees were identified and measured.

About two-thirds of the sample plots that were in timberland at the time of the 1981 inventory and predicted to be undisturbed until this inventory were not remeasured. Growth and mortality for these plots were predicted using the STEMS models as a means of obtaining

growth and current volume. A comparison of the predicted growth and mortality for these undisturbed plots and observations for growth and mortality for the one-third sample of remeasured undisturbed plots was used to adjust the model predictions to accommodate local conditions. The adjustment procedure is a modified version of the method described by Smith (1983).

The undisturbed timberland plots whose growth and mortality were predicted were treated in the estimation process as measured ground plots, even though they were not visited by field crews. The plot records for these plots were sent to the field for verification of current ownership information. All old plots classified as disturbed were selected for remeasurement to assess and verify changes since the last inventory. Table B summarizes the distribution of all ground plots for the 1994 Kansas inventory by type and plot.

COMPUTATION OF ESTIMATES: AREA

All area estimates were made using two-phase estimation methods. In this type of estimation, a preliminary estimate of area by land use is obtained from the stratification (Phase 1) and corrected by the plot measurements (Phase 2). A complete description of this estimation method is presented by Loetsch and Haller (1964).

COMPUTATION OF ESTIMATES: VOLUME

Estimates of volume per acre were made from the measurements and predictions for trees on each of the 10 subplots per plot. For each condition class on a plot, the volume per acre estimate was multiplied by the area estimate represented by the condition, and these products were summed over all plots to obtain estimates of total volume for the condition class. Net cubic and board foot volumes are based on tree measurements (d.b.h., tree class, and site index) and volume equations presented by Hahn and Hansen (1991).

COMPUTATION OF ESTIMATES: GROWTH AND MORTALITY

On remeasured plots, estimates of growth and mortality per acre were derived from remeasurements and observations of trees that died between inventories. These estimates were based on the remeasurement of the 1981 inventory plots using the 1981 plot design. Growth, reported as average annual net growth between the 1981 and 1994 inventories, was computed from data for both plots that had been remeasured and plots whose growth and mortality had been predicted using methods presented by Van Deusen *et al.* (1986). Average annual mortality was also calculated for the remeasurement period.

Table B.—*Distribution of ground plots by ground land-use class and type of plot, 1994 inventory of Kansas's forest resources*

	Sample base[1]						
	1981 NC-FIA remeasurement				NRCS-NRI		Total plots
	Remeasured		Updated		New		
	East	West	East	West	East	West	
Timberland	957	72	174	26	379	61	1,669
Reserved forest land	6	2	3	0	1	0	12
Other forest land	28	4	0	0	5	2	39
Nonforest with trees	625	124	147	15	141	30	1,082
Nonforest without trees	4,782	5,105	38	1	614	1,454	11,994
Water	49	22	4	0	5	4	84
Total	6,447	5,329	366	42	1,145	1,551	14,880

[1] *Plots that straddle more than one land use are included in the table in the first land-use class that occurs on this list. For example, a plot that straddled other forest land and water would be included in this table as other forest land.*

On new plots, estimates of growth and mortality were obtained by using the STEMS models to predict growth and mortality for 1 year. Current diameter and living tree estimates for old undisturbed plots were predicted using growth and mortality predictions and were derived in the same manner as for remeasured plots. Predictions of growth and mortality using the STEMS models were adjusted for each survey unit to accommodate local conditions using data from the undisturbed remeasured plots. As with volume, total growth and mortality estimates were obtained by multiplying the plot-level per acre estimates by area expansion factors and then summing over plots. Current annual net growth for 1994 was computed using adjusted, 1-year STEMS predictions of growth for all inventory plots.

COMPUTATION OF ESTIMATES: AVERAGE ANNUAL REMOVALS

Average annual growing-stock and sawtimber removals (1981-1993) were estimated only from the remeasured plots. These estimates were based on the remeasurement of the 1981 inventory plots using the 1981 plot design. Measurements for new plots and predictions from the STEMS models were not used to estimate removals. These estimates were obtained from trees measured in the last inventory and either cut or otherwise removed from the timberland base. Because re-measurement plots constitute about one-half the total ground plots, and not all remeasured plots had cutting, average annual removals estimates have greater sampling errors than volume and growth estimates.

TREE AND LOG GRADES

The USDA Forest Service reports all board foot volume in International 1/4-inch rule. Log grades and tree grades are based on the classification of external characteristics as indicators of quality. Log grades or tree grades were taken on approximately one-third of the sample plots in Kansas. All sawtimber softwood sample trees were graded for quality and assigned a butt log grade. All sawtimber hardwood sample trees were graded for quality and assigned a tree grade. The volume yield by log grade or tree grade for this sample was used to distribute the volume of the ungraded sample trees by species group.

Hardwood sawtimber trees were graded according to "Hardwood tree grades for factory lumber" (Hanks 1976). The best 12-foot section of the lowest 16-foot hardwood log was used for grading. Hardwood sawtimber trees that did not meet minimum tree grade specifications for grades 1 through 3 were assigned grade 4 according to Forest Service standard specifications for hardwood construction logs described in "A guide to hardwood log grading" (Rast *et al.* 1973).

Eastern redcedar sawtimber trees were graded according to Forest Service standard specifications. For all softwoods, the first merchantable 16-foot log or shorter lengths down to 12 feet were used for grading.

Hardwood Tree Grades for Factory Lumber [a]

Grade factor	Tree grade 1	Tree grade 2	Tree grade 3
Length of grading zone (feet)	Butt 16	Butt 16	Butt 16
Length of grading section [b] (feet)	Best 12	Best 12	Best 12
D.b.h., minimum (inches)	16[c]	13	11
D.i.b., minimum at top of grading section (inches)	13[c] 16 20	11[d] 12	8
Clear cuttings (on the three best faces):[e]			
Length, minimum (feet)	7 5 3	3 3	2
Number on face (maximum)	2	2 3	unlimited
Yield in face length (minimum)	5/6	4/6	3/6
Cull deduction (including crook and sweep, but excluding shake) maximum within grading section (percent)	9	f	50

a Hanks (1976)

b Whenever a 14- or 16-foot section of the butt 16-foot log is better than the best 12-foot section, the grade of the longer section will become the grade of the tree. This longer section is the basis for determining the grading factors such as diameter and cull deduction.

c In basswood and ash, diameter inside bark (d.i.b.) at top of grading section must be 12 inches and d.b.h. must be 15 inches.

d Grade 2 trees can be 10 inches d.i.b. at top of grading section if otherwise meeting surface requirements for small grade 1's.

e A clear cutting is a portion of a face free of defects, extending the width of the face. A face is one-fourth of the surface of the grading section as divided lengthwise.

f Fifteen percent crook and sweep or 40 percent total cull deduction are permitted in grade 2, if size and surface of grading section qualify as grade 1. If rot shortens the required clear cuttings to the extent of dropping the butt log to grade 2, do not drop the tree's grade to 3 unless the cull deduction for rot is greater than 40 percent.

Forest Service Standard Specifications for Hardwood Construction Logs (tie and timber logs) [a] [b]

Position in tree	Butts and uppers
Minimum diameter, small end	8 inches
Minimum length without trim	8 feet
Clear cuttings	No requirements
Sweep allowance	One-fourth of the diameter at small end for each 8 feet of length.
Sound surface defects:	
Single knots	Any number, if no knot has an average diameter above the callus in excess of one-third of the log diameter at point of occurrence.
Whorled knots	Any number, if the sum of knot diameters above the callus does not exceed one-third of the log diameter at point of occurrence.
Holes	Any number, provided none has a diameter over one-third of log diameter at point of occurrence and none extends more than 3 inches into included timber[c].
Unsound defects :	
Surface	Same requirements as for sound defects if they extend into included timber. No limit if they do not.
Interior	None permitted except one shake not more than one-third the width of contained tie or timber, and one split, not over 5 inches.

[a] Rast *et al.* (1973).

[b] These specifications are minimum for the class. If, from a group of logs, factory logs are selected first, thus leaving only nonfactory logs from which to select construction logs, then the quality range of the construction logs so selected is limited, and the class may be considered a grade. If selection for construction logs is given first priority, it may be necessary to subdivide the class into grades.

[c] Included timber is always square, and dimension is judged from small end.

Log Grades for Eastern Redcedar Logs

Grade 1

1. Trees must be 16 inches in diameter or larger, grading section 12 feet in length or longer, and with deduction for defect not over 30 percent of gross scale.

2. Trees must be at least 75 percent clear on each of three faces.

3. All knots outside clear cutting must be sound and not more than 2-1/2 inches in size.

Grade 2

1. Trees must be 12 inches in diameter or larger, grading section 12 feet in length or longer, and with a net scale after deduction for defect of at least 50 percent of the gross scale deducted for defect.

2. Trees must be at least 50 percent clear on each of three faces or 75 percent clear on two faces.

Grade 3

1. Trees must be 6 inches in diameter or larger, grading section 12 feet in length or longer, and with a net scale after deduction for defect of at least 50 percent of the gross contents of the log.

Note: Diameters are diameter inside bark (d.i.b.) at small end of grading section. Percent clear refers to percent clear in one continuous section.

METRIC EQUIVALENTS OF UNITS USED IN THIS REPORT

1 acre = 4,046.86 square meters or 0.405 hectare.
1,000 acres = 405 hectares.
1 cubic foot = 0.0283 cubic meter.
1 foot = 30.48 centimeters or 0.3048 meter.
1 inch = 25.4 millimeters, 2.54 centimeters, or 0.0254 meter.
1 pound = 0.454 kilograms.
1 ton = 0.907 metric tons.

TREE SPECIES GROUPS IN KANSAS (LITTLE 1981)

Note: Many additional tree species have been planted around homes, farm buildings, and in towns and cities. However, only those species encountered during the 1994 inventory of the forest resources of Kansas are listed here.

Softwoods
Eastern redcedar[1] ..... *Juniperus virginiana*
Hardwoods
Boxelder[1] ..... *Acer negundo*
Silver maple[1] ..... *A. saccharinum*
Sugar maple[2] ..... *A. saccharum*
River birch[1] ..... *Betula nigra*
Select hickories[2]
  Pecan ..... *Carya illinoensis*
  Shellbark hickory ..... *C. laciniosa*
  Shagbark hickory ..... *C. ovata*
  Mockernut hickory ..... *C. tomentosa*
Other hickories[2]
  Bitternut hickory ..... *C. cordiformis*
  Black hickory ..... *C. texana*
Sugarberry[1] ..... *Celtis laevigata*
Hackberry[1] ..... *C. occidentalis*
Ashes[2]
  White ash ..... *Fraxinus americana*
  Green ash ..... *F. pennsylvanica*
Kentucky coffeetree[1] ..... *Gymnocladus dioicus*
Black walnut[2] ..... *Juglans nigra*
Sycamore[1] ..... *Platanus occidentalis*
Eastern cottonwood[1] ..... *Populus deltoides*
Black cherry[1] ..... *Prunus serotina*
Select white oaks[2]
  White oak ..... *Quercus alba*
  Bur oak ..... *Q. macrocarpa*
  Chinkapin oak ..... *Q. muehlenbergii*
Other white oaks[2]
  Post oak ..... *Q. stellata*
Select red oaks[2]
  Northern red oak ..... *Q. rubra*
  Shumard oak ..... *Q. shumardii*
Other red oaks[2]
  Blackjack oak ..... *Q. marilandica*
  Shingle oak ..... *Q. imbricaria*
  Pin oak ..... *Q. palustris*
  Black oak ..... *Q. velutina*
American basswood[1] ..... *Tilia americana*
Black willow[1] ..... *Salix nigra*
Elm
  American elm[1] ..... *Ulmus americana*
  Siberian elm[1] ..... *U. pumila*
  Slippery elm[1] ..... *U. rubra*
Other hardwoods
  Buckeye[1] ..... *Aesculus* spp.
  Northern catalpa[1] ..... *Catalpa speciosa*
  Persimmon[2] ..... *Diospyros virginiana*
  Honeylocust[2] ..... *Gleditsia triacanthos*
  White mulberry[1] ..... *Morus alba*
  Red mulberry[1] ..... *M. rubra*
  Black locust[2] ..... *Robinia pseudoacacia*
  Sassafras[1] ..... *Sassafras albidum*
Noncommercial species
  Ailanthus ..... *Ailanthus altissima*
  Eastern redbud ..... *Cercis canadensis*
  Hawthorn ..... *Crataegus* spp.
  Osage-orange ..... *Maclura pomifera*
  Apple ..... *Malus* spp.
  Eastern hophornbeam ..... *Ostrya virginiana*
  Wild plum ..... *Prunus* spp.
  Soapberry ..... *Saponaria*

DEFINITION OF TERMS

Average annual mortality of growing stock.—The average cubic foot volume of sound wood in growing-stock trees that died in 1 year. Average annual mortality is the average for the years between inventories (1981 to 1993 in this report).

Average annual mortality of sawtimber.—The average board foot volume of sound wood in sawtimber trees that died in 1 year. Average annual mortality is the average for the years between inventories (1981 to 1993 in this report).

Average annual removals from growing stock.—The average net growing-stock volume in growing-stock trees removed annually for roundwood forest products, in

[1] *This species or species group is considered a soft hardwood, with an average specific gravity of less than 0.50.*

[2] *This species or species group is considered a hard hardwood, with an average specific gravity greater than or equal to 0.50.*

addition to the volume of logging residues and the volume of other removals. Average annual removals of growing stock are the average for the years between inventories (1981 to 1993 in this report) and are based on information obtained from remeasurement plots (see Survey Procedures in Appendix).

Average annual removals from sawtimber.—The average net board foot sawtimber volume of live sawtimber trees removed annually for roundwood forest products, in addition to the volume of logging residues and the volume of other removals. Average annual removals of sawtimber are the average for the years between inventories (1981 to 1993 in this report) and are based on information obtained from remeasurement plots (see Survey Procedures in Appendix).

Average annual net growth of growing stock.—The annual change in cubic foot volume of sound wood in live sawtimber and poletimber trees, and the total volume of trees entering these classes through ingrowth, less volume losses resulting from natural causes. Average net annual growing stock is the average for the years between inventories (1981 to 1993 in this report).

Average annual net growth of sawtimber.—The annual change in the board foot volume of live sawtimber trees, and the total volume of trees reaching sawtimber size, less volume losses resulting from natural causes. Average net annual growth of sawtimber is the average for the years between inventories (1981 to 1993 in this report).

Basal area.—Tree area in square feet of the cross section at breast height of a single tree. When the basal areas of all trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Biomass.—The aboveground volume of all live trees (including bark but excluding foliage) reported in green tons (i.e., green weight). Biomass has four components:

Bole.—Biomass of a tree from 1 foot above the ground to a 4-inch top outside bark.

Tops and limbs.—Total biomass of a tree from a 1-foot stump minus the bole.

1- to 5-inch trees.—Total aboveground biomass of a tree from 1 to 5 inches in diameter at breast height.

Stump.—Biomass of a tree 5 inches d.b.h. and larger from the ground to a height of 1 foot.

Bolts.—Roundwood logs of less than 8 feet in length that are converted into shingles, cooperage stock, dimension stock, blocks, blanks, excelsior, etc. No minimum diameter limits. Does not include logs used for the manufacture of pulp or veneer.

Commercial species.—Tree species presently or prospectively suitable for industrial wood products. (Note: Excludes species of typically small size, poor form, or inferior quality such as hophornbeam, Osage-orange, and redbud.)

Cord.—One standard cord is 128 cubic feet of stacked wood, including bark and air space. Cubic feet can be converted to solid wood standard cords by dividing by 79.

Corporate.—Lands owned by a private corporation not in the business of operating primary wood-using plants.

County and municipal land.—Land owned by counties and local public agencies or municipalities, or land leased to these governmental units for 50 years or more.

Cropland.—Land under cultivation within the last 24 months; including cropland harvested, crop failures, cultivated summer fallow, idle cropland used only for pasture, orchards, active Christmas tree plantations indicated by annual shearing, nurseries, and land in soil improvement crops, but excluding land cultivated in developing improved pasture.

Cull.—Portions of a tree that are unusable for industrial-wood products because of rot, missing or dead material, form, or other defect.

Current annual net growth of growing stock.—The annual change in volume of sound wood in live sawtimber and poletimber trees, and the total volume of trees entering these classes through ingrowth, less volume losses resulting from

natural causes, reported for a single year (1993 in this report). Current growth is based on an estimate of the current annual increment of each growing-stock tree in the inventory.

Current annual net growth of sawtimber.—The annual change in the volume of live sawtimber trees, and the total volume of trees reaching sawtimber size, less volume losses resulting from natural causes, reported for a single year (1993 in this report). Current growth is based on an estimate of the current annual increment of each growing-stock tree in the inventory.

Current annual removals from growing stock.—The current net growing-stock volume in growing-stock trees removed annually for roundwood forest products, in addition to the volume of logging residues, and the volume of other removals. Current annual removals of growing stock are reported for a single year (1993 in this report); they are based on a survey of primary wood processing mills to determine removals for products and on information from remeasurement plots (see Survey Procedures in Appendix) to determine removals due to land-use change.

Current annual removals from sawtimber.—The current net board foot sawtimber volume of live sawtimber trees removed annually for roundwood forest products, in addition to the volume of logging residues, and the volume of other removals. Current annual removals of sawtimber are reported for a single year (1993 in this report); they are based on a survey of primary wood processing mills to determine removals for products and on information from remeasurement plots (see Survey Procedures in Appendix) to determine removals due to land-use change.

Diameter class.—A classification of trees based on diameter outside bark, measured at breast height 4.5 feet above the ground. (Note d.b.h. is the common abbreviation for diameter at breast height.) Two-inch diameter classes are commonly used in Forest Inventory and Analysis, with the even inch the approximate midpoint for a class. For example, the 6-inch class includes trees 5.0 through 6.9 inches d.b.h.

Diameter at breast height (d.b.h.).—The outside bark diameter at 4.5 feet (1.37 m) above the forest floor on the uphill side of the tree. For determining breast height, the forest floor includes the duff layer that may be present, but does not include unincorporated woody debris that may rise above the ground line.

Federal land.—Land administered by agencies of the Federal government.

Forest land.—Land at least 10 percent stocked (note: Historically 16.7 percent was used based on full stocking equaling 167 percent. Consequently, this was equal to a standard of 10 percent based on a 100-percent scale that is now used.) by forest trees of any size, or formerly having had such tree cover, and not currently developed for nonforest use. (Note: Stocking is measured by comparing specified standards with basal area and/or number of trees, age or size, and spacing.) The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, or other bodies of water or clearings in forest areas shall be classed as forest if less than 120 feet wide. (See Tree, Land, Timberland, Reserved forest land, Other forest land, Stocking, and Water.)

Forest type.—A classification of forest land based on the species forming a plurality of live tree stocking. The associated species for each forest type are based on net volume of growing stock and all live biomass by species group from the 1994 inventory of Kansas forests. Forest types in Kansas are:

Eastern redcedar.—Forests in which eastern redcedar comprises a plurality of the stocking. Species commonly associated with the eastern redcedar forest type in Kansas include white and red oaks, and black walnut.

Eastern redcedar-hardwoods.—Forests in which hardwoods comprise a plurality of the stocking but in which eastern redcedar comprises between 25 and 50 percent of the stocking. Species commonly associated with the eastern redcedar-hardwoods forest type

in Kansas include select white oak, cottonwood, black walnut, hackberry, and elm.

Red oak-white oak-hickory.—Forests in which red oak, white oak, hickories, singly or in combination, comprise a plurality of the stocking. Species commonly associated with the red oak-white oak-hickory forest type in Kansas include black walnut, ash, hackberry, and elm.

Bur oak.—Forest in which bur oak comprises a plurality of the stocking. Species commonly associated with the bur oak forest type in Kansas are other hickory, hackberry, ash, and, to a lesser degree, black walnut and other white oak.

Post-blackjack oak.—Forests in which post oak and blackjack oak, singly or in combination, comprise a majority of the stocking. Species commonly associated with the post-blackjack oak forest type in Kansas include select white and red oaks, and, to a lesser degree, hackberry.

Cottonwood.—Forests in which cottonwood comprises a majority of the stocking. Species commonly associated with the cottonwood forest type in Kansas include willow, elm, ash, soft maple, hackberry, and black walnut.

Elm-ash-cottonwood.—Forests in which ash, hackberry, cottonwood, soft maple, and elm comprise a plurality of the stocking. Species commonly associated with the elm-ash-cottonwood forest type in Kansas include sycamore, black walnut, bur oak, and willow.

Willow.—Forests in which black willow comprises a majority of the stocking. Species commonly associated with the willow forest type in Kansas include cottonwood, eastern redcedar, select white oak, and hickories.

Lowland plains hardwoods.—Forests in which hackberry, black walnut, bur oak, cottonwood, elm, ash, select red oaks, and sycamore comprise a plurality of the stocking. Other hardwood species commonly associated with the lowland plains hardwoods type in Kansas include hickories and basswood.

Elm-ash-locust.—Forests in which elm, white and green ash, and locust comprise a plurality of the stocking. Species commonly associated with the elm-ash-locust forest type in Kansas include cottonwood, hackberry, select white oaks, black walnut, soft maple, sycamore, willow, hickories, and select red oak.

Growing-stock tree.—A live tree of commercial species that meets specified standards of size, quality, and merchantability. (Note: Excludes rough, rotten, and dead trees.)

Growing-stock volume.—Net volume in cubic feet of growing-stock trees 5.0 inches d.b.h. and over, from 1 foot above the ground to a minimum 4.0-inch top diameter outside bark of the central stem or to the point where the central stem breaks into limbs.

Hard hardwoods.—Hardwood species with an average specific gravity greater than 0.50 such as oaks, hard maple, hickories, and ash.

Hardwoods.—Dicotyledonous trees, usually broad-leaved and deciduous. (See Soft hardwoods and Hard hardwoods.)

Indian land.—Land held in trust by the United States for tribes or individual Indians.

Industrial wood.—All roundwood products except residential fuelwood.

Land.—*(a) Bureau of the Census.*—Dry land and land temporarily or partly covered by water such as marshes, swamps, and river flood plains (omitting tidal flats below mean high tide); streams, sloughs, estuaries, and canals less than one-eighth of a statute mile wide; and lakes, reservoirs, and ponds less than 40 acres in area.

(b) Forest Inventory and Analysis.—The same as the Bureau of the Census, except minimum width of streams, etc., is 120 feet and minimum size of lakes, etc., is 1 acre.

Live trees.—Growing-stock, rough, and rotten trees 1.0 inch d.b.h. and larger.

Log grade.—A log classification based on external characteristics as indicators of quality or value. Log grade was assigned to a sample of softwood sawtimber trees throughout the State during the 1996 inventory. Also see Tree grade. (See Appendix for specific grading factors used.)

Logging residue.—The unused portions of cut trees, plus unused trees killed by logging.

Marsh.—Nonforest land that characteristically supports low, generally herbaceous or shrubby vegetation, and that is intermittently covered with water.

Merchantable.—Refers to a pulpwood or saw-log section that meets pulpwood or saw-log specifications, respectively.

Net volume.—Gross volume less deductions for rot, sweep, or other defect affecting use for timber products.

Noncommercial species.—Tree species of typically small size, poor form, or inferior quality that normally do not develop into trees suitable for industrial wood products.

Nonforest land.—Land that has never supported forests, and land formerly forested where use for timber management is precluded by development for other uses. (Note: Includes areas used for crops, active Christmas tree plantations as indicated by annual shearing, orchards, nurseries, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, powerline clearings of any width, and 1- to 40-acre areas of water classified by the Bureau of the Census as land.) If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide and more than 1 acre in area to qualify as nonforest land.

Nonforest land without trees.—Nonforest land with no live trees present.

Nonforest land with trees.—Nonforest land with one or more trees per acre at least 5 inches d.b.h.

Nonstocked land.—Timberland less than 10 percent stocked with all live trees.

Other forest land.—Forest land not capable of producing 20 cubic feet per acre per year of industrial wood crops under natural conditions and not associated with urban or rural development. Many of these sites contain tree species that are not currently used for industrial wood production or trees of poor form, small size, or inferior quality that are unfit for most industrial products. Unproductivity may be the result of adverse site conditions such as sterile soil, dry climate, poor drainage, high elevation, and rockiness. This land is not withdrawn from timber use.

Other removals.—Growing-stock trees removed but not used for products, or trees left standing but "removed" from the timberland classification by land use change. Examples are removals from cultural operations such as timber stand improvement work and land clearing, and the standing volume on land classified originally as timberland but later designated as reserved from timber harvesting (such as a newly established State park).

Ownership size class.—The amount of timberland owned by one owner, regardless of the number of parcels.

Pasture with trees.—Land presently used for grazing and less than 10 percent stocked with trees.

Physiographic class.—A measure of soil and water conditions that affect tree growth on a site. The physiographic classes are:

Xeric sites.—Very dry soils where excessive drainage seriously limits both growth and species occurrence. These sites are usually on upland and upper half slopes.

Xeromesic sites.—Moderately dry soils where excessive drainage limits growth and species occurrence to some extent. These sites are usually on the lower half slopes.

Mesic sites.—Deep, well-drained soils. Growth and species occurrence are limited only by climate. These include all cove sites and bottomlands along intermittent streams.

Hydromesic sites.—Moderately wet soils where insufficient drainage or infrequent flooding limits growth and species occurrence to some extent.

Hydric sites.—Very wet sites where excess water seriously limits both growth and species occurrence.

Plant byproducts.—Plant residues used for products such as mulch, pulp chips, and fuelwood.

Plantation.—An artificially reforested area sufficiently productive to qualify as timberland. The planted species is not necessarily predominant. Christmas tree plantations, which are considered cropland, are not included.

Plant residues.—Wood and bark materials generated at manufacturing plants during production of other products.

Poletimber stand.—(See Stand-size class.)

Poletimber tree.—A live tree of commercial species at least 5.0 inches d.b.h., but smaller than sawtimber size.

Potential productivity class.—A classification of forest land in terms of inherent capacity to grow crops of industrial wood. The class identifies the potential growth in merchantable cubic feet/acre/year at culmination of mean annual increment of fully stocked natural stands.

Private individual land.—Privately owned land not owned by forest industry. This class includes the formerly used Farmer and Miscellaneous private classes.

Reserved forest land.—Forest land withdrawn from timber use through statute, administrative regulation, or designation. Note: Christmas tree plantations were once classified as reserved forest land. Now, however, they are classified as cropland.

Rotten tree.—Live trees of commercial species that do not contain at least one 12-foot saw log or two saw logs 8 feet or longer, now or prospectively, and/or do not meet regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

Rough tree.—(a) Live trees of commercial species that do not contain at least one merchantable 12-foot saw log or two saw logs 8 feet or longer, now or prospectively, and/or do not meet regional specifications for freedom from defect primarily because of roughness or poor form, and (b) all live trees of noncommercial species.

Roundwood products.—Logs, bolts, or other round sections (including chips from roundwood) cut from trees for industrial or consumer uses. (Note: Includes saw logs, veneer logs, and bolts; cooperage logs and bolts; pulpwood; fuelwood; pilings; poles; posts; hewn ties; mine timbers; and various other round, split, or hewn products.)

Salvable dead tree.—A standing or down dead tree considered merchantable by regional standards.

Sapling.—A live tree 1.0 to 5.0 inches d.b.h.

Sapling-seedling stand.—(See Stand-size class.)

Saw log.—A log meeting minimum standards of diameter, length, and defect, including logs at least 8 feet long, sound and straight and with a minimum diameter outside bark (d.o.b.) for softwoods of 7.0 inches (9.0 inches for hardwoods) or other combinations of size and defect specified by regional standards.

Saw-log portion.—That part of the bole of sawtimber trees between the stump and the saw-log top.

Saw-log top.—The point on the bole of sawtimber trees above which a saw log cannot be produced. The minimum saw-log top is 7.0 inches d.o.b. for softwoods and 9.0 inches d.o.b. for hardwoods.

Sawtimber stand.—(See Stand-size class.)

Sawtimber tree.—A live tree of commercial species containing at least a 12-foot saw log or two noncontiguous saw logs 8 feet or longer, and meeting regional specifications for freedom from defect. Softwoods must be at least 9.0 inches d.b.h. Hardwoods must be at least 11.0 inches d.b.h.

Sawtimber volume.—Net volume of the saw-log portion of live sawtimber in board feet, International 1/4-inch rule (unless specified otherwise), from stump to a minimum 7.0 inches top d.o.b. for softwoods and a minimum 9.0 inches top d.o.b. for hardwoods.

Seedling.—A live tree less than 1.0 inch d.b.h. that is expected to survive. Only softwood seedlings more than 6 inches tall and hardwood seedlings more than 1 foot tall are counted.

Short-log (rough tree).—A sawtimber-size tree of commercial species that contains at least one merchantable 8- to 11-foot saw log but not a 12-foot saw log.

Shrub.—A woody, perennial plant differing from a perennial herb in its persistent and woody stem(s) and less definitely from a tree in its lower stature and/or the general

absence of a well-defined main stem. For this report, shrubs were separated somewhat arbitrarily into tall and low shrubs as follows:

Tall shrubs.—Normally taller than 1.6 to 3.2 feet.

Low shrubs.—Normally shorter than 1.6 to 3.2 feet. (Woody perennial vines, such as grape, were included with low shrubs.)

Shrub and tree seedling biomass.—The total aboveground weight of trees less than 1.0 inch in diameter and all shrubs.

Site index.—An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Soft hardwoods.—Hardwood species with an average specific gravity less than 0.50, such as cottonwood, silver maple, basswood, and willow.

Softwoods.—Coniferous trees, usually evergreen, having needles or scale-like leaves.

Stand.—A group of trees on a minimum of 1 acre of forest land that is stocked by forest trees of any size.

Stand-age class.—A classification based on age of the main stand. Main stand refers to trees of the dominant forest type and stand-size class.

Stand-size class.—A classification of stocked (see Stocking) forest land based on the size class of live trees on the area; that is, sawtimber, poletimber, or seedlings and saplings.

Sawtimber stands.—Stands with half or more of live tree stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

Poletimber stands.—Stands with half or more of live tree stocking in poletimber and/or sawtimber trees, and with poletimber stocking exceeding that of sawtimber.

Sapling-seedling stands.—Stands with more than half of the live tree stocking in saplings and/or seedlings.

State land.—Land owned by the State of Kansas or leased to it for 50 years or more.

Stocking.—The degree of occupancy of land by live trees, measured by basal area and/or the number of trees in a stand by size or age and spacing, compared to the basal area and/or number of trees required to fully use the growth potential of the land; that is, the stocking standard. A stocking percent of 100 indicates full use of the site and is equivalent to 80 square feet of basal area per acre in trees 5.0 inches d.b.h. and larger. In a stand of trees less than 5 inches d.b.h., a stocking percent of 100 would indicate that the present number of trees is sufficient to produce 80 square feet of basal area per acre when the trees reach 5 inches d.b.h.

Stands are grouped into the following stocking classes:

Overstocked stands.—Stands in which stocking of live trees is 133.0 percent or more.

Fully stocked stands.—Stands in which stocking of live trees is from 100.0 to 132.9 percent.

Medium stocked stands.—Stands in which stocking of live trees is from 60.0 to 99.9 percent.

Poorly stocked stands.—Stands in which stocking of live trees is from 16.7 to 59.9 percent.

Nonstocked areas.—Timberland on which stocking of live trees is less than 16.7 percent.

Timber products output.—All timber products cut from roundwood and byproducts of wood manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees, cull trees, salvable dead trees, trees on nonforest land, noncommercial species, sapling-size trees, and limbwood. Byproducts from primary manufacturing plants include slabs, edging, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and screenings of pulpmills that are used as pulpwood chips or other products.

Timberland.—Forest land that is producing, or is capable of producing, more than 20 cubic feet per acre per year of industrial wood crops under natural conditions, that is not withdrawn from timber use, and that is not associated with urban or rural development. Currently inaccessible and inoperable areas are included. (Timberland was formerly called commercial forest land.)

Tree.—A woody plant usually having one or more erect perennial stems, a stem diameter at breast height of at least 3 inches, a more or less definitely formed crown of foliage, and a height of at least 13 feet at maturity.

Tree biomass.—The total aboveground weight (including the bark but excluding the foliage) of all trees from 1 to 5 inches in d.b.h., and the total aboveground weight (including the bark but excluding the foliage) from a 1-foot stump for trees more than 5 inches in diameter.

Tree grade.—A classification of the lower 16 feet of the bole of standing trees based on external characteristics as indicators of the quality and quantity of lumber that could be produced from the tree. Tree grade was assigned to a sample of hardwood sawtimber trees during the 1994 inventory. Also see Log grade. (See Appendix for specific grading factors used.)

Tree size class.—A classification of trees based on diameter at breast height, including sawtimber trees, poletimber trees, saplings, and seedlings.

Upper stem portion.—That part of the bole of sawtimber trees above the saw-log top to a minimum top diameter of 4.0 inches d.o.b. or to the point where the central stem breaks into limbs.

Urban and other areas.—Areas within the legal boundaries of cities and towns; suburban areas developed for residential, industrial, or recreational purposes; school yards; cemeteries; roads; railroads; airports; beaches; powerlines and other rights-of-way; or other nonforest land not included in any other specified land use class.

Urban forest land.—Land that would otherwise meet the criteria for timberland but that is in an urban-suburban area surrounded by commercial, industrial, or residential development and not likely to be managed for the production of industrial wood products on a continuing basis. Wood removed would be for land clearing, fuelwood, or esthetic purposes. Such forest land may be associated with industrial, commercial, residential subdivision, industrial parks, golf course perimeters, airport buffer strips, and public urban parks that qualify as forest land.

Water.—*(a) Bureau of the Census.*—Permanent inland water surfaces, such as lakes, reservoirs, and ponds at least 40 acres in area; and streams, sloughs, estuaries, and canals at least one-eighth of a statute mile wide.

(b) Noncensus.—Permanent inland water surfaces, such as lakes, reservoirs, and ponds from 1 to 39.9 acres in area; and streams, sloughs, estuaries, and canals from 120 feet to one-eighth of a statute mile wide.

Windbreak.—A group of trees less than 120 feet wide used for protection of soil, cropfields, and buildings.

Wooded pasture.—Pasture with more than 10 percent stocking in live trees, but less than 25 percent stocking in growing-stock trees. Area is currently used for grazing or there is other evidence of grazing.

Wooded strip.—An acre or more of natural continuous forest land that would otherwise meet survey standards for timberland except that it is less than 120 feet wide.

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Table 1. -- Area of land by Forest Survey Unit, county/county group, and major land-use class, Kansas, 1994

(In thousand acres)

Forest Survey Unit and county/county group	Total land area [1]	Forest land				Other land [2]
		Total forest	Timberland	Reserved forest land	Other forest land	
Northeastern						
Atchison	206.7	25.1	24.8	0.3	--	181.6
Clay Center[3]	1,456.8	43.7	40.5	1.5	1.7	1,413.1
Doniphan	207.1	33.0	32.7	0.3	--	174.1
Douglas	223.3	28.2	27.5	0.7	--	195.1
Franklin	261.7	27.4	26.8	0.6	--	234.3
Jackson	523.0	29.2	28.8	0.2	0.2	493.8
Jefferson	254.6	42.3	41.9	0.4	--	212.3
Johnson-Wyandotte	295.0	35.1	34.4	0.7	--	259.9
Leavenworth	222.3	38.5	38.1	0.4	--	183.8
Marshall	741.8	28.8	28.8	--	--	713.0
Miami	272.2	46.0	45.0	1.0	--	226.2
Nemaha-Brown	1,101.4	31.3	31.3	--	--	1,070.1
Osage	335.1	35.4	34.7	0.7	--	299.7
Pottawatomie	658.8	42.4	41.8	0.3	0.3	616.4
Riley-Geary	602.1	49.9	47.2	1.2	1.5	552.2
Shawnee	441.9	25.8	25.6	0.1	0.1	416.1
Wabaunsee	637.3	32.2	31.8	0.2	0.2	605.1
Total	8,441.1	594.3	581.7	8.6	4.0	7,846.8
Southeastern						
Anderson	405.3	30.6	29.4	--	1.2	374.7
Bourbon	441.0	49.7	48.4	--	1.3	391.3
Butler	1,030.8	25.3	22.7	--	2.6	1,005.5
Chautauqua	444.5	50.2	44.7	--	5.5	394.3
Cherokee	353.7	46.4	45.9	--	0.5	307.3
Coffey	335.7	20.2	20.2	--	--	315.5
Cowley	826.0	25.5	23.3	--	2.2	800.5
Crawford	360.6	43.8	43.3	--	0.5	316.8
Elk	462.4	30.3	27.2	--	3.1	432.1
Emporia[4]	1,681.8	57.4	57.4	--	--	1,624.4
Greenwood	823.6	29.9	26.9	--	3.0	793.7
Labette	387.3	37.2	36.9	--	0.3	350.1
Linn	425.8	62.9	61.4	--	1.5	362.9
Montgomery	415.3	50.6	49.8	--	0.8	364.7
Neosho	342.9	31.0	30.7	--	0.3	311.9
Wilson	355.6	50.4	49.8	--	0.6	305.2
Woodson-Allen	715.2	45.6	43.7	--	1.9	669.6
Total	9,807.5	687.0	661.7	--	25.3	9,120.5
Western						
Colby-Garden City-Dodge City[5]	18,383.3	19.8	16.3	--	3.5	18,363.5
Great Bend-Hutchinson[6]	5,080.7	33.0	33.0	--	--	5,047.7
Hays[7]	3,872.2	62.9	62.9	--	--	3,809.3
Jewell-Mitchell	781.0	36.3	32.0	2.4	1.9	744.7
Republic-Cloud	686.3	33.4	30.0	2.1	1.3	652.9
Salina[8]	1,354.4	33.0	27.7	4.3	1.0	1,321.4
Wichita[9]	3,960.0	46.4	46.4	--	--	3,913.6
Total	34,117.9	264.8	248.3	8.8	7.7	33,853.1
All counties	52,366.5	1,546.1	1,491.7	17.4	37.0	50,820.4

[1] From U. S. Bureau of the Census, 1990.

[2] Includes 91.4 thousand acres of water according to FIA standards of area classification, but defined by the Bureau of the Census as land.

[3] Includes: Clay, Dickinson, and Washington counties.

[4] Includes: Chase, Lyon, Marion, and Morris counties.

[5] Includes: Cheyenne, Clark, Comanche, Decatur, Finney, Ford, Gove, Grant, Gray, Greeley, Hamilton, Haskell, Hodgeman, Kearny, Kiowa, Lane, Logan, Meade, Morton, Ness, Rawlins, Scott, Seward, Sheridan, Sherman, Stanton, Stevens, Thomas, Wallace, and Wichita counties.

[6] Includes: Barton, Edwards, Harvey, McPherson, Pawnee, Reno, Rice, Rush, and Stafford counties.

[7] Includes: Ellis, Graham, Norton, Osborne, Phillips, Rooks, Russell, Smith, and Trego counties.

[8] Includes: Ellsworth, Lincoln, Ottawa, and Saline counties.

[9] Includes: Barber, Harper, Kingman, Pratt, Sedgwick, and Sumner counties.

Table 2. -- Area of timberland by Forest Survey Unit, county/county group, and ownership class, Kansas, 1994

(In thousand acres)

Forest Survey Unit and county/county group	All owners	Ownership class					
		Federal	State	County and municipal	Indian	Corporate	Individual
Northeastern							
Atchison	24.8	1.2	0.3	--	--	0.8	22.5
Clay Center[1]	40.5	2.8	0.5	--	--	0.8	36.4
Doniphan	32.7	1.6	0.4	--	--	1.1	29.6
Douglas	27.5	1.5	0.1	0.1	--	2.1	23.7
Franklin	26.8	1.6	0.1	0.1	--	2.0	23.0
Jackson	28.8	0.2	0.2	0.6	0.3	1.0	26.5
Jefferson	41.9	2.0	0.4	--	--	1.3	38.2
Johnson-Wyandotte	34.4	2.0	0.2	0.1	--	3.0	29.1
Leavenworth	38.1	1.8	0.4	--	--	1.2	34.7
Marshall	28.8	1.9	0.4	--	0.5	1.3	24.7
Miami	45.0	2.4	0.2	0.2	--	3.6	38.6
Nemaha-Brown	31.3	2.2	0.7	--	0.5	0.7	27.2
Osage	34.7	2.0	0.2	0.1	--	3.0	29.4
Pottawatomie	41.8	0.2	0.2	0.7	0.6	1.4	38.7
Riley-Geary	47.2	4.8	1.0	--	--	0.8	40.6
Shawnee	25.6	0.1	0.2	0.5	0.3	0.8	23.7
Wabaunsee	31.8	0.2	0.2	0.6	0.3	1.2	29.3
Total	581.7	28.5	5.7	3.0	2.5	26.1	515.9
Southeastern							
Anderson	29.4	0.2	1.0	0.1	--	1.4	26.7
Bourbon	48.4	0.4	1.6	0.2	--	2.5	43.7
Butler	22.7	0.4	0.2	0.1	--	1.3	20.7
Chautauqua	44.7	1.2	0.7	0.3	--	3.1	39.4
Cherokee	45.9	0.3	3.3	0.2	--	3.1	39.0
Coffey	20.2	0.9	--	--	--	0.6	18.7
Cowley	23.3	0.5	0.3	0.1	--	1.5	20.9
Crawford	43.3	0.3	2.8	0.1	--	3.3	36.8
Elk	27.2	0.7	0.4	0.1	--	1.9	24.1
Emporia[2]	57.4	2.2	--	--	--	2.6	52.6
Greenwood	26.9	0.6	0.3	0.1	--	1.7	24.2
Labette	36.9	0.2	2.7	0.1	--	2.6	31.3
Linn	61.4	0.6	2.1	0.4	--	3.2	55.1
Montgomery	49.8	0.3	2.9	0.2	--	5.0	41.4
Neosho	30.7	0.2	2.3	0.1	--	2.2	25.9
Wilson	49.8	0.3	2.5	0.1	--	3.7	43.2
Woodson-Allen	43.7	0.3	1.6	0.2	--	2.0	39.6
Total	661.7	9.6	24.7	2.4	--	41.7	583.3
Western							
Colby-Garden City-Dodge City[3]	16.3	--	--	--	--	1.9	14.4
Great Bend-Hutchinson[4]	33.0	0.4	0.4	0.8	--	--	31.4
Hays[5]	62.9	11.0	--	--	--	--	51.9
Jewell-Mitchell	32.0	0.9	--	--	--	2.0	29.1
Republic-Cloud	30.0	0.9	--	--	--	1.9	27.2
Salina[6]	27.7	0.8	--	--	--	1.7	25.2
Wichita[7]	46.4	0.6	0.8	1.3	--	--	43.7
Total	248.3	14.6	1.2	2.1	--	7.5	222.9
All counties	1,491.7	52.7	31.6	7.5	2.5	75.3	1,322.1

[1] Includes: Clay, Dickinson, and Washington counties.

[2] Includes: Chase, Lyon, Marion, and Morris counties.

[3] Includes: Cheyenne, Clark, Comanche, Decatur, Finney, Ford, Gove, Grant, Gray, Greeley, Hamilton, Haskell, Hodgeman, Kearny, Kiowa, Lane, Logan, Meade, Morton, Ness, Rawlins, Scott, Seward, Sheridan, Sherman, Stanton, Stevens, Thomas, Wallace, and Wichita counties.

[4] Includes: Barton, Edwards, Harvey, McPherson, Pawnee, Reno, Rice, Rush, and Stafford counties.

[5] Includes: Ellis, Graham, Norton, Osborne, Phillips, Rooks, Russell, Smith, and Trego counties.

[6] Includes: Ellsworth, Lincoln, Ottawa, and Saline counties.

[7] Includes: Barber, Harper, Kingman, Pratt, Sedgwick, and Sumner counties.

Table 3. -- Area of timberland by Forest Survey Unit, county/county group, and forest type group/local type, Kansas, 1994

(In thousand acres)

Forest Survey Unit and county/county group	All types	Forest type group/local type													
		Eastern redcedar			Oak-hickory				Elm-ash-cottonwood				Maple-beech-birch	Elm-ash-locust	Non-stocked
		Total	Eastern redcedar	Eastern redcedar-hardwood	Total	Red oak-white oak-hickory	Bur oak	Post-blackjack oak	Total	Cotton-wood	Elm-ash-cotton-wood	Willow	Lowland plains hardwoods	Elm-ash-locust	Non-stocked
Northeastern															
Atchison	24.8	0.1	--	0.1	8.6	8.4	--	0.2	2.8	0.1	2.6	0.1	5.7	7.6	--
Clay Center[1]	40.5	3.9	2.0	1.9	6.6	5.3	1.3	--	7.6	1.2	6.2	0.2	10.8	11.0	0.6
Doniphan	32.7	0.0	--	--	11.1	10.8	--	0.3	4.3	0.2	4.1	--	7.5	9.8	--
Douglas	27.5	1.4	0.3	1.1	7.3	7.1	0.1	0.1	2.4	0.1	2.3	--	6.3	10.0	0.1
Franklin	26.8	1.3	0.3	1.0	7.1	6.9	0.1	0.1	2.6	0.1	2.5	--	6.1	9.7	--
Jackson	28.8	1.1	0.3	0.8	6.5	5.4	0.9	0.2	2.0	0.2	1.8	--	6.8	12.1	0.3
Jefferson	41.9	0.4	--	0.4	14.1	13.8	--	0.3	4.4	0.2	3.8	0.4	9.6	13.4	--
Johnson-Wyandotte	34.4	1.5	0.4	1.1	9.7	9.3	0.2	0.2	3.2	0.2	3.0	--	8.1	11.9	--
Leavenworth	38.1	0.4	--	0.4	12.8	12.5	--	0.3	4.1	0.2	3.6	0.3	8.8	12.0	--
Marshall	28.8	0.9	0.1	0.8	6.4	4.4	2.0	--	2.8	0.4	1.3	1.1	6.4	12.1	0.2
Miami	45.0	2.0	0.5	1.5	12.7	12.2	0.3	0.2	3.8	0.2	3.6	--	10.8	15.7	--
Nemaha-Brown	31.3	1.2	0.1	1.1	6.4	4.0	2.4	--	3.3	0.7	1.6	1.0	7.0	13.1	0.3
Osage	34.7	1.5	0.4	1.1	9.7	9.3	0.2	0.2	3.4	0.2	3.2	--	8.0	12.1	--
Pottawatomie	41.8	1.8	0.5	1.3	9.6	8.0	1.3	0.3	2.4	0.3	2.1	--	10.2	17.3	0.5
Riley-Geary	47.2	6.2	3.1	3.1	8.3	7.0	1.3	--	7.2	1.9	5.2	0.1	12.0	12.6	0.9
Shawnee	25.6	1.1	0.3	0.8	5.9	4.9	0.8	0.2	1.8	0.2	1.6	--	6.0	10.5	0.3
Wabaunsee	31.8	1.2	0.3	0.9	7.1	5.8	1.1	0.2	1.9	0.3	1.6	--	7.3	14.0	0.3
Total	581.7	26.0	8.6	17.4	149.9	135.1	12.0	2.8	60.0	6.7	50.1	3.2	137.4	204.9	3.5
Southeastern															
Anderson	29.4	4.5	1.4	3.1	8.2	6.6	--	1.6	2.4	--	2.4	--	7.0	7.3	--
Bourbon	48.4	6.6	2.4	4.2	14.4	11.9	--	2.5	3.8	--	3.8	--	11.4	12.1	0.1
Butler	22.7	--	--	--	8.7	2.7	--	6.0	3.9	--	3.9	--	6.7	3.3	0.1
Chautauqua	44.7	--	--	--	22.3	6.6	--	15.7	5.9	--	5.9	--	9.4	7.0	0.1
Cherokee	45.9	1.1	0.3	0.8	15.1	9.0	0.1	6.0	8.6	2.3	6.3	--	7.5	13.4	0.2
Coffey	20.2	0.3	--	0.3	2.2	2.2	--	--	4.9	--	4.9	--	6.8	6.0	--
Cowley	23.3	--	--	--	9.4	3.0	--	6.4	3.9	--	3.9	--	6.4	3.6	--
Crawford	43.3	1.3	0.5	0.8	14.4	8.7	--	5.7	7.8	1.8	6.0	--	7.1	12.5	0.2
Elk	27.2	0.0	--	--	12.9	3.9	--	9.0	3.9	--	3.9	--	6.2	4.1	0.1
Emporia[2]	57.4	0.8	--	0.8	5.7	5.7	--	--	14.5	--	14.5	--	18.4	18.0	--
Greenwood	26.9	--	--	--	11.5	3.5	--	8.0	4.2	--	4.2	--	7.0	4.1	0.1
Labette	36.9	0.8	0.2	0.6	11.7	7.1	--	4.6	7.0	1.6	5.4	--	6.2	11.0	0.2
Linn	61.4	8.1	3.1	5.0	18.5	15.3	--	3.2	4.8	--	4.8	--	14.2	15.7	0.1
Montgomery	49.8	2.9	2.1	0.8	16.3	10.0	0.1	6.2	8.3	1.9	6.4	--	7.4	14.7	0.2
Neosho	30.7	0.6	0.1	0.5	9.5	5.8	--	3.7	6.0	1.5	4.5	--	5.1	9.3	0.2
Wilson	49.8	1.7	0.9	0.8	15.4	9.2	0.1	6.1	8.0	1.6	6.4	--	7.7	16.8	0.2
Woodson-Allen	43.7	7.0	1.9	5.1	11.8	9.5	--	2.3	3.7	--	3.7	--	10.3	10.9	--
Total	661.7	35.7	12.9	22.8	208.0	120.7	0.3	87.0	101.6	10.7	90.9	--	144.8	169.8	1.8
Western															
Colby-Garden City-Dodge City[3]	16.3	--	--	--	--	--	--	--	11.8	11.8	--	--	--	4.5	--
Great Bend-Hutchinson[4]	33.0	3.4	0.6	2.8	0.5	0.5	--	--	6.6	5.0	1.5	0.1	7.6	14.1	0.8
Hays[5]	62.9	--	--	--	12.3	11.1	1.2	--	19.1	13.9	5.2	--	7.7	23.8	--
Jewell-Mitchell	32.0	--	--	--	1.5	0.7	0.8	--	10.2	4.4	5.8	--	5.7	14.6	--
Republic-Cloud	30.0	--	--	--	1.4	0.7	0.7	--	8.9	3.3	5.6	--	5.5	14.2	--
Salina[6]	27.7	--	--	--	1.2	0.6	0.6	--	7.8	2.7	5.1	--	4.9	13.8	--
Wichita[7]	46.4	3.7	0.9	2.8	0.7	0.7	--	--	9.2	7.0	2.2	--	12.4	19.1	1.3
Total	248.3	7.1	1.5	5.6	17.6	14.3	3.3	--	73.6	48.1	25.4	0.1	43.8	104.1	2.1
All counties	1,491.7	68.8	23.0	45.8	375.5	270.1	15.6	89.8	235.2	65.5	166.4	3.3	326.0	478.8	7.4

[1] Includes: Clay, Dickinson, and Washington counties.

[2] Includes: Chase, Lyon, Marion, and Morris counties.

[3] Includes: Cheyenne, Clark, Comanche, Decatur, Finney, Ford, Gove, Grant, Gray, Greeley, Hamilton, Haskell, Hodgeman, Kearny, Kiowa, Lane, Logan, Meade, Morton, Ness, Rawlins, Scott, Seward, Sheridan, Sherman, Stanton, Stevens, Thomas, Wallace, and Wichita counties.

[4] Includes: Barton, Edwards, Harvey, McPherson, Pawnee, Reno, Rice, Rush, and Stafford counties.

[5] Includes: Ellis, Graham, Norton, Osborne, Phillips, Rooks, Russell, Smith, and Trego counties.

[6] Includes: Ellsworth, Lincoln, Ottawa, and Saline counties.

[7] Includes: Barber, Harper, Kingman, Pratt, Sedgwick, and Sumner counties.

Table 4. -- Area of timberland by Forest Survey Unit, county/county group, and stand-size class, Kansas, 1994

(In thousand acres)

Forest Survey Unit and county/county group	All stands	Stand-size class			
		Sawtimber	Poletimber	Sapling-Seedling	Nonstocked
Northeastern					
Atchison	24.8	12.7	7.9	4.2	--
Clay Center[1]	40.5	19.4	11.9	8.6	0.6
Doniphan	32.7	16.4	11.2	5.1	--
Douglas	27.5	11.7	10.8	4.9	0.1
Franklin	26.8	11.5	10.7	4.6	--
Jackson	28.8	13.2	8.6	6.7	0.3
Jefferson	41.9	21.0	14.0	6.9	--
Johnson-Wyandotte	34.4	15.0	14.0	5.4	--
Leavenworth	38.1	19.1	12.8	6.2	--
Marshall	28.8	14.2	6.6	7.8	0.2
Miami	45.0	19.5	18.6	6.9	--
Nemaha-Brown	31.3	16.5	7.2	7.3	0.3
Osage	34.7	15.1	14.1	5.5	--
Pottawatomie	41.8	18.5	13.1	9.7	0.5
Riley-Geary	47.2	24.3	14.3	7.7	0.9
Shawnee	25.6	11.7	7.7	5.9	0.3
Wabaunsee	31.8	13.9	9.7	7.9	0.3
Total	581.7	273.7	193.2	111.3	3.5
Southeastern					
Anderson	29.4	11.1	10.0	8.3	--
Bourbon	48.4	18.9	17.7	11.7	0.1
Butler	22.7	8.1	9.0	5.6	--
Chautauqua	44.7	18.5	17.9	8.2	0.1
Cherokee	45.9	17.7	16.9	11.1	0.2
Coffey	20.2	13.9	5.2	1.1	--
Cowley	23.3	9.0	9.1	5.2	--
Crawford	43.3	16.5	15.9	10.7	0.2
Elk	27.2	11.1	10.8	5.2	0.1
Emporia[2]	57.4	38.2	16.0	3.2	--
Greenwood	26.9	10.3	10.6	5.9	0.1
Labette	36.9	13.7	13.6	9.3	0.3
Linn	61.4	24.3	23.3	13.7	0.1
Montgomery	49.8	18.1	16.7	14.8	0.2
Neosho	30.7	11.3	11.2	8.0	0.2
Wilson	49.8	17.0	17.2	15.4	0.2
Woodson-Allen	43.7	16.1	14.3	13.3	--
Total	661.7	273.8	235.4	150.7	1.8
Western					
Colby-Garden City-Dodge City[3]	16.3	14.8	0.4	1.1	--
Great Bend-Hutchinson[4]	33.0	18.6	8.3	5.3	0.8
Hays[5]	62.9	48.1	9.3	5.5	--
Jewell-Mitchell	32.0	20.2	5.5	6.3	--
Republic-Cloud	30.0	18.6	5.3	6.1	--
Salina[6]	27.7	17.2	4.8	5.7	--
Wichita[7]	46.4	27.1	9.7	8.3	1.3
Total	248.3	164.6	43.3	38.3	2.1
All counties	1,491.7	712.1	471.9	300.3	7.4

[1] Includes: Clay, Dickinson, and Washington counties.

[2] Includes: Chase, Lyon, Marion, and Morris counties.

[3] Includes: Cheyenne, Clark, Comanche, Decatur, Finney, Ford, Gove, Grant, Gray, Greeley, Hamilton, Haskell, Hodgeman, Kearny, Kiowa, Lane, Logan, Meade, Morton, Ness, Rawlins, Scott, Seward, Sheridan, Sherman, Stanton, Stevens, Thomas, Wallace, and Wichita counties.

[4] Includes: Barton, Edwards, Harvey, McPherson, Pawnee, Reno, Rice, Rush, and Stafford counties.

[5] Includes: Ellis, Graham, Norton, Osborne, Phillips, Rooks, Russell, Smith, and Trego counties.

[6] Includes: Ellsworth, Lincoln, Ottawa, and Saline counties.

[7] Includes: Barber, Harper, Kingman, Pratt, Sedgwick, and Sumner counties.

Table 5. -- Area of timberland by Forest Survey Unit, county/county group, and potential productivity class, Kansas, 1994

(In thousand acres)

Forest Survey Unit and county/county group	All classes	Potential productivity class (cubic feet of growth per acre per year)				
		165+	120-164	85-119	50-84	20-49
Northeastern						
Atchison	24.8	--	0.9	5.4	11.0	7.5
Clay Center[1]	40.5	--	0.8	7.0	16.0	16.7
Doniphan	32.7	--	1.2	7.9	14.4	9.2
Douglas	27.5	--	0.5	5.1	10.7	11.2
Franklin	26.8	--	0.4	5.1	10.5	10.8
Jackson	28.8	0.2	0.5	4.7	10.0	13.4
Jefferson	41.9	--	1.4	9.8	19.1	11.6
Johnson-Wyandotte	34.4	--	0.5	6.0	14.1	13.8
Leavenworth	38.1	--	1.3	8.9	17.4	10.5
Marshall	28.8	--	0.2	5.0	12.0	11.6
Miami	45.0	--	0.8	7.3	18.5	18.4
Nemaha-Brown	31.3	--	0.3	5.7	12.9	12.4
Osage	34.7	--	0.5	6.2	14.1	13.9
Pottawatomie	41.8	0.2	0.7	6.9	14.6	19.4
Riley-Geary	47.2	--	1.4	8.0	17.1	20.7
Shawnee	25.6	0.2	0.4	4.1	8.9	12.0
Wabaunsee	31.8	0.2	0.6	5.2	11.1	14.7
Total	581.7	0.8	12.4	108.3	232.4	227.8
Southeastern						
Anderson	29.4	0.1	0.9	8.0	8.8	11.6
Bourbon	48.4	0.2	1.1	12.2	15.2	19.7
Butler	22.7	--	2.4	3.6	5.7	11.0
Chautauqua	44.7	--	1.4	6.3	13.4	23.6
Cherokee	45.9	0.3	3.4	8.0	20.7	13.5
Coffey	20.2	0.7	0.2	2.9	9.1	7.3
Cowley	23.3	--	2.0	3.7	6.1	11.5
Crawford	43.3	0.3	3.2	7.7	19.2	12.9
Elk	27.2	--	1.3	4.0	7.9	14.0
Emporia[2]	57.4	1.9	0.6	8.8	25.7	20.4
Greenwood	26.9	--	2.0	4.1	7.3	13.5
Labette	36.9	0.2	2.9	6.6	16.6	10.6
Linn	61.4	0.2	1.3	14.9	19.8	25.2
Montgomery	49.8	0.3	3.5	8.1	22.9	15.0
Neosho	30.7	0.2	2.4	5.6	13.8	8.7
Wilson	49.8	0.3	3.2	7.8	24.3	14.2
Woodson-Allen	43.7	0.1	1.6	12.4	12.7	16.9
Total	661.7	4.8	33.4	124.7	249.2	249.6
Western						
Colby-Garden City-Dodge City[3]	16.3	--	--	--	4.2	12.1
Great Bend-Hutchinson[4]	33.0	--	3.3	4.2	10.2	15.3
Hays[5]	62.9	--	--	4.3	22.3	36.3
Jewell-Mitchell	32.0	--	2.1	2.7	8.7	18.5
Republic-Cloud	30.0	--	1.1	2.6	8.4	17.9
Salina[6]	27.7	--	0.7	2.3	8.0	16.7
Wichita[7]	46.4	--	3.7	7.1	15.2	20.4
Total	248.3	--	10.9	23.2	77.0	137.2
All counties	1,491.7	5.6	56.7	256.2	558.6	614.6

[1] Includes: Clay, Dickinson, and Washington counties.

[2] Includes: Chase, Lyon, Marion, and Morris counties.

[3] Includes: Cheyenne, Clark, Comanche, Decatur, Finney, Ford, Gove, Grant, Gray, Greeley, Hamilton, Haskell, Hodgeman, Kearny, Kiowa, Lane, Logan, Meade, Morton, Ness, Rawlins, Scott, Seward, Sheridan, Sherman, Stanton, Stevens, Thomas, Wallace, and Wichita counties.

[4] Includes: Barton, Edwards, Harvey, McPherson, Pawnee, Reno, Rice, Rush, and Stafford counties.

[5] Includes: Ellis, Graham, Norton, Osborne, Phillips, Rooks, Russell, Smith, and Trego counties.

[6] Includes: Ellsworth, Lincoln, Ottawa, and Saline counties.

[7] Includes: Barber, Harper, Kingman, Pratt, Sedgwick, and Sumner counties.

Table 6. -- Area of timberland by Forest Survey Unit, county/county group, and stocking class of growing-stock trees[1], Kansas, 1994

(In thousand acres)

Forest Survey Unit and county/county group	All classes	Stocking class of growing-stock trees				
		Nonstocked[2]	Poorly stocked	Moderately stocked	Fully stocked	Over-stocked
Northeastern						
Atchison	24.8	0.3	8.2	12.2	4.1	--
Clay Center[3]	40.5	2.1	18.4	13.7	6.3	--
Doniphan	32.7	0.5	11.8	15.1	5.2	0.1
Douglas	27.5	0.6	10.3	9.7	5.9	1.0
Franklin	26.8	0.6	10.0	9.7	5.6	0.9
Jackson	28.8	2.8	12.8	9.9	3.2	0.1
Jefferson	41.9	0.4	14.0	20.1	7.4	--
Johnson-Wyandotte	34.4	0.7	12.8	12.6	7.6	0.7
Leavenworth	38.1	0.4	12.7	18.3	6.6	0.1
Marshall	28.8	1.8	12.1	8.1	6.5	0.3
Miami	45.0	0.8	16.9	16.5	9.8	1.0
Nemaha-Brown	31.3	2.5	12.2	9.5	6.7	0.4
Osage	34.7	0.8	12.9	12.7	7.5	0.8
Pottawatomie	41.8	3.6	18.6	14.4	5.1	0.1
Riley-Geary	47.2	2.7	21.2	17.0	6.2	0.1
Shawnee	25.6	2.5	11.4	8.8	2.9	--
Wabaunsee	31.8	2.9	14.4	10.6	3.8	0.1
Total	581.7	26.0	230.7	218.9	100.4	5.7
Southeastern						
Anderson	29.4	0.9	11.4	10.4	5.5	1.2
Bourbon	48.4	0.8	18.7	17.8	10.0	1.1
Butler	22.7	1.9	11.1	7.6	2.0	0.1
Chautauqua	44.7	2.2	19.8	17.1	5.3	0.3
Cherokee	45.9	1.4	19.2	16.1	9.2	--
Coffey	20.2	1.1	6.6	8.9	3.6	--
Cowley	23.3	1.8	10.8	8.4	2.2	0.1
Crawford	43.3	1.3	18.7	15.1	8.2	--
Elk	27.2	1.5	12.2	10.2	3.1	0.2
Emporia[4]	57.4	3.6	19.2	23.9	10.6	0.1
Greenwood	26.9	1.9	12.5	9.6	2.7	0.2
Labette	36.9	1.2	15.9	12.4	7.4	--
Linn	61.4	0.8	23.7	22.5	13.3	1.1
Montgomery	49.8	1.4	23.0	17.4	8.0	--
Neosho	30.7	1.0	13.2	10.2	6.2	0.1
Wilson	49.8	1.6	20.6	15.8	11.8	--
Woodson-Allen	43.7	1.6	16.8	15.3	7.9	2.1
Total	661.7	26.0	273.4	238.7	117.0	6.6
Western						
Colby-Garden City-Dodge City[5]	16.3	0.8	7.7	3.0	4.8	--
Great Bend-Hutchinson[6]	33.0	3.9	17.1	11.0	1.0	--
Hays[7]	62.9	18.8	24.0	12.8	7.3	--
Jewell-Mitchell	32.0	2.5	16.2	8.9	4.4	--
Republic-Cloud	30.0	2.4	14.7	8.6	4.3	--
Salina[8]	27.7	2.1	13.3	8.2	4.1	--
Wichita[9]	46.4	5.2	23.3	16.4	1.5	--
Total	248.3	35.7	116.3	68.9	27.4	--
All counties	1,491.7	87.7	620.4	526.5	244.8	12.3

[1] This table is based on the stocking percent of growing-stock trees, rather than that of all live trees. For this table, to use the definition of stocking found in the Appendix, replace the term "all live" by "growing-stock."

[2] Area of nonstocked in this table and in table 8 differs from that in other tables in this report because this table includes land stocked only with growing-stock trees, rather than with all live trees.

[3] Includes: Clay, Dickinson, and Washington counties.

[4] Includes: Chase, Lyon, Marion, and Morris counties.

[5] Includes: Cheyenne, Clark, Comanche, Decatur, Finney, Ford, Gove, Grant, Gray, Greeley, Hamilton, Haskell, Hodgeman, Kearny, Kiowa, Lane, Logan, Meade, Morton, Ness, Rawlins, Scott, Seward, Sheridan, Sherman, Stanton, Stevens, Thomas, Wallace, and Wichita counties.

[6] Includes: Barton, Edwards, Harvey, McPherson, Pawnee, Reno, Rice, Rush, and Stafford counties.

[7] Includes: Ellis, Graham, Norton, Osborne, Phillips, Rooks, Russell, Smith, and Trego counties.

[8] Includes: Ellsworth, Lincoln, Ottawa, and Saline counties.

[9] Includes: Barber, Harper, Kingman, Pratt, Sedgwick, and Sumner counties.

Table 7. -- Area of timberland by forest type group/local type and ownership class, Kansas, 1994

(In thousand acres)

Forest type group/ local type	All ownerships	Ownership class							
		Total public	Public			Total private	Private		
			Federal	State	County and municipal		Indian	Corporate	Individual
Eastern redcedar									
Eastern redcedar	23.0	0.8	0.8	--	--	22.2	--	2.8	19.4
Eastern redcedar-hardwood	45.8	1.2	--	1.2	--	44.6	0.7	0.9	43.0
Total	68.8	2.0	0.8	1.2	--	66.8	0.7	3.7	62.4
Oak-hickory									
Red oak-white oak-hickory	270.1	23.8	16.0	6.0	1.8	246.3	--	15.4	230.9
Bur oak	15.6	0.4	0.4	--	--	15.2	--	0.7	14.5
Post-blackjack oak	89.8	0.8	0.8	--	--	89.0	--	6.0	83.0
Total	375.5	25.0	17.2	6.0	1.8	350.5	--	22.1	328.4
Elm-ash-cottonwood									
Cottonwood	65.5	9.1	0.4	8.7	--	56.4	--	2.5	53.9
Elm-ash-cottonwood	166.4	11.1	8.5	2.6	--	155.3	--	11.6	143.7
Willow	3.3	1.2	1.2	--	--	2.1	--	--	2.1
Total	235.2	21.4	10.1	11.3	--	213.8	--	14.1	199.7
Maple-beech-birch									
Lowland plains hardwoods	326.0	16.6	12.4	2.8	1.4	309.4	--	13.7	295.7
Total	326.0	16.6	12.4	2.8	1.4	309.4	--	13.7	295.7
Elm-ash-locust									
Elm-ash-locust	478.8	23.8	11.3	10.3	2.2	455.0	1.8	20.4	432.8
Total	478.8	23.8	11.3	10.3	2.2	455.0	1.8	20.4	432.8
Nonstocked	7.4	3.0	0.9	--	2.1	4.4	--	1.3	3.1
All forest types	1,491.7	91.8	52.7	31.6	7.5	1,399.9	2.5	75.3	1,322.1

Table 8. -- Area of timberland by ownership class and stocking class of growing-stock trees[1], Kansas, 1994

(In thousand acres)

Ownership class	All classes	Stocking class of growing-stock trees				
		Nonstocked [2]	Poorly stocked	Moderately stocked	Fully stocked	Over-stocked
Public						
Federal	52.7	14.3	15.8	17.4	5.2	--
State	31.6	1.8	14.0	9.4	5.4	1.0
County and municipal	7.5	2.1	3.0	2.4	--	--
Total	91.8	18.2	32.8	29.2	10.6	1.0
Private						
Indian	2.5	--	1.0	0.8	0.7	--
Corporate	75.3	3.1	31.7	28.1	11.5	0.9
Individual	1,322.1	66.4	554.9	468.4	222.0	10.4
Total	1,399.9	69.5	587.6	497.3	234.2	11.3
All ownerships	1,491.7	87.7	620.4	526.5	244.8	12.3

[1] This table is based on the stocking percent of growing-stock trees, rather than that of all live trees. For this table, to use the definition of stocking found in the Appendix, replace the term "live" with "growing-stock."

[2] Area of nonstocked in this table and in table 6 differs from that in other tables in this report because this table includes land stocked only with growing-stock trees, rather than with "live" trees.

Table 9. -- Area of timberland by forest type group/local type and stand-size class, Kansas, 1994

(In thousand acres)

Forest type group/ local type	All stands	Stand-size class			
		Sawtimber	Poletimber	Sapling-Seedling	Nonstocked
Eastern redcedar					
Eastern redcedar	23.0	4.0	5.0	14.0	--
Eastern redcedar-hardwood	45.8	10.2	16.1	19.5	--
Total	68.8	14.2	21.1	33.5	--
Oak-hickory					
Red oak-white oak-hickory	270.1	138.8	94.8	36.5	--
Bur oak	15.6	9.6	5.4	0.6	--
Post-blackjack oak	89.8	19.1	52.2	18.5	--
Total	375.5	167.5	152.4	55.6	--
Elm-ash-cottonwood					
Cottonwood	65.5	56.5	9.0	--	--
Elm-ash-cottonwood	166.4	95.5	52.5	18.4	--
Willow	3.3	0.1	1.1	2.1	--
Total	235.2	152.1	62.6	20.5	--
Maple-beech-birch					
Lowland plains hardwoods	326.0	161.8	109.8	54.4	--
Total	326.0	161.8	109.8	54.4	--
Elm-ash-locust					
Elm-ash-locust	478.8	216.5	126.0	136.3	--
Total	478.8	216.5	126.0	136.3	--
Nonstocked	7.4	--	--	--	7.4
All forest types	1,491.7	712.1	471.9	300.3	7.4

Table 10. -- Number of all live trees on timberland by species group and diameter class, Kansas, 1994

(In thousand trees)

Species group	All classes	Diameter class (inches at breast height)											
		1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods													
Eastern redcedar	28,127	15,479	7,062	3,475	1,277	499	187	90	42	5	4	7	--
Total softwoods	28,127	15,479	7,062	3,475	1,277	499	187	90	42	5	4	7	--
Hardwoods													
Select white oak	26,955	9,953	3,814	3,669	2,900	2,024	1,337	1,070	559	460	367	642	160
Other white oak	21,016	5,622	5,285	4,516	2,868	1,379	620	394	165	84	37	46	--
Select red oak	12,692	4,706	2,245	1,664	817	1,009	718	507	303	234	156	274	59
Other red oak	16,616	6,273	4,114	2,478	1,363	921	462	393	202	145	89	154	22
Select hickory	20,953	10,666	4,080	2,778	1,743	801	328	237	135	60	71	49	5
Other hickory	15,514	8,606	3,621	1,348	925	516	293	103	54	26	9	11	2
Basswood	2,518	930	558	414	184	178	68	59	51	37	15	24	--
Hard maple	3,134	1,875	633	284	181	72	61	25	2	1	--	--	--
Soft maple	4,780	1,326	1,356	362	269	309	318	141	152	173	108	203	63
Elm	128,040	72,078	31,718	12,778	5,561	3,140	1,302	648	334	212	85	165	19
White & green ash	47,033	22,306	9,577	6,107	3,307	2,370	1,303	650	562	304	221	256	70
Sycamore	1,965	285	405	178	292	125	101	129	84	70	63	144	89
Cottonwood	5,432	42	165	348	463	501	677	813	477	427	377	790	352
Willow	2,999	633	534	512	259	294	287	204	89	67	33	86	1
Hackberry	81,461	40,797	15,815	8,881	5,853	3,869	2,470	1,478	866	587	296	489	60
Black cherry	3,975	2,120	648	538	319	206	50	44	25	8	5	12	--
Black walnut	26,324	7,019	5,179	4,198	3,884	2,287	1,710	965	589	250	122	108	13
Other hardwoods	76,888	36,716	15,673	9,358	5,834	3,457	2,552	1,398	718	461	296	353	72
Total hardwoods	498,295	231,953	105,420	60,411	37,022	23,458	14,657	9,258	5,367	3,606	2,350	3,806	987
Noncommercial species	82,059	49,949	18,189	7,189	3,295	1,552	925	410	190	148	88	99	25
All species	608,481	297,381	130,671	71,075	41,594	25,509	15,769	9,758	5,599	3,759	2,442	3,912	1,012

Table 11. -- Number of all growing-stock trees on timberland by species group and diameter class, Kansas, 1994

(In thousand trees)

Species group	All classes	Diameter class (inches at breast height)											
		1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods													
Eastern redcedar	26,466	15,147	6,666	3,122	966	355	129	53	23	5	--	--	--
Total softwoods	26,466	15,147	6,666	3,122	966	355	129	53	23	5	--	--	--
Hardwoods													
Select white oak	20,353	9,281	2,825	2,568	1,673	1,207	749	645	341	322	230	421	91
Other white oak	18,001	5,462	4,422	3,799	2,191	1,119	474	306	118	63	30	17	--
Select red oak	11,261	4,619	1,983	1,340	728	844	584	414	219	174	116	202	38
Other red oak	13,910	6,003	3,499	1,778	971	636	332	249	148	110	62	113	9
Select hickory	19,184	10,400	3,556	2,318	1,551	668	268	178	111	51	57	21	5
Other hickory	14,501	8,373	3,360	1,193	725	445	248	77	46	21	7	6	--
Basswood	1,929	882	339	277	137	123	44	30	38	34	11	14	--
Hard maple	2,781	1,875	402	240	149	54	36	22	2	1	--	--	--
Soft maple	3,435	1,026	1,095	193	223	209	143	88	106	135	68	138	11
Elm	107,925	69,382	24,438	8,275	3,238	1,475	498	272	124	89	39	84	11
White & green ash	40,006	21,646	7,459	4,683	2,459	1,736	701	432	327	196	159	160	48
Sycamore	1,536	285	291	153	192	65	89	92	70	61	58	115	65
Cottonwood	4,531	42	90	327	440	406	562	673	428	373	326	616	248
Willow	1,808	516	300	199	133	213	136	144	65	31	11	59	1
Hackberry	70,713	39,884	12,604	6,722	4,513	2,892	1,616	933	572	391	207	331	48
Black cherry	3,161	1,839	573	327	226	138	20	13	14	8	3	--	--
Black walnut	21,182	6,657	4,221	3,027	2,942	1,765	1,220	632	421	162	72	63	--
Other hardwoods	50,296	30,487	9,423	4,900	2,253	1,440	660	491	260	142	107	100	33
Total hardwoods	406,513	218,659	80,880	42,319	24,744	15,435	8,380	5,691	3,410	2,364	1,563	2,460	608
All species	432,979	233,806	87,546	45,441	25,710	15,790	8,509	5,744	3,433	2,369	1,563	2,460	608

Table 12. -- Net volume of growing stock on timberland by species group and diameter class, Kansas, 1994

(In thousand cubic feet)

Species group	All classes	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods											
Eastern redcedar	16,587	6,376	4,241	2,740	1,609	915	562	144	--	--	--
Total softwoods	16,587	6,376	4,241	2,740	1,609	915	562	144	--	--	--
Hardwoods											
Select white oak	134,610	5,773	8,224	10,625	10,832	13,766	10,396	12,972	11,939	35,502	14,581
Other white oak	46,996	7,853	9,755	9,001	6,048	5,859	3,327	2,250	1,391	1,512	--
Select red oak	75,025	3,276	3,810	7,743	8,423	9,065	6,876	7,205	6,268	16,500	5,859
Other red oak	47,419	3,619	4,315	5,509	4,886	5,276	4,641	4,610	3,176	9,796	1,591
Select hickory	40,009	5,082	7,595	6,297	4,311	4,390	3,752	2,356	3,621	1,772	833
Other hickory	19,865	2,661	3,643	4,100	4,082	1,850	1,561	955	438	575	--
Basswood	8,659	654	652	1,172	672	747	1,278	1,502	653	1,329	--
Hard maple	3,113	515	834	504	614	522	56	68	--	--	--
Soft maple	37,615	446	1,216	1,971	2,355	2,204	3,452	6,044	3,944	13,042	2,941
Elm	74,779	16,580	14,826	12,668	6,839	5,780	3,794	3,510	2,094	6,754	1,934
White & green ash	110,257	10,627	12,275	16,300	11,005	10,042	10,981	8,663	9,054	13,901	7,409
Sycamore	44,240	444	1,085	802	1,618	2,528	2,710	2,965	3,840	12,917	15,331
Cottonwood	211,488	914	2,670	3,802	9,199	16,805	15,012	17,500	20,140	62,553	62,893
Willow	18,028	527	783	2,076	2,201	3,473	2,415	1,376	601	4,467	109
Hackberry	181,464	14,457	20,478	24,478	22,546	19,655	17,441	15,991	11,493	26,927	7,998
Black cherry	4,172	781	921	1,032	286	285	428	293	146	--	--
Black walnut	94,419	6,587	14,183	15,476	17,143	13,560	12,430	6,499	3,709	4,832	--
Other hardwoods	86,579	9,967	10,172	12,647	9,506	10,854	8,374	6,176	5,882	8,183	4,818
Total hardwoods	1,238,737	90,763	117,437	136,203	122,566	126,661	108,924	100,935	88,389	220,562	126,297
All species	1,255,324	97,139	121,678	138,943	124,175	127,576	109,486	101,079	88,389	220,562	126,297

Table 13. -- Net volume of growing stock in the saw-log portion of sawtimber trees on timberland by species group and diameter class, Kansas, 1994

(In thousand cubic feet)

Species group	All classes	Diameter class (inches at breast height)							
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods									
Eastern redcedar	5,151	2,222	1,420	841	529	139	--	--	--
Total softwoods	5,151	2,222	1,420	841	529	139	--	--	--
Hardwoods									
Select white oak	99,052	--	7,894	11,267	9,038	11,719	11,057	33,845	14,232
Other white oak	16,326	--	4,134	4,631	2,834	2,007	1,276	1,444	--
Select red oak	53,791	--	6,290	7,536	6,073	6,552	5,841	15,775	5,724
Other red oak	30,021	--	3,593	4,317	4,056	4,199	2,946	9,349	1,561
Select hickory	17,880	--	3,090	3,557	3,256	2,123	3,365	1,679	810
Other hickory	7,664	--	2,981	1,509	1,359	866	403	546	--
Basswood	5,564	--	514	635	1,143	1,383	613	1,276	--
Hard maple	997	--	459	427	49	62	--	--	--
Soft maple	31,118	--	1,750	1,825	3,021	5,486	3,668	12,472	2,896
Elm	26,084	--	4,769	4,661	3,274	3,143	1,937	6,409	1,891
White & green ash	62,658	--	8,059	8,247	9,622	7,859	8,408	13,258	7,205
Sycamore	39,587	--	1,231	2,138	2,413	2,714	3,595	12,439	15,057
Cottonwood	192,130	--	7,097	14,309	13,423	16,124	18,929	60,266	61,982
Willow	12,328	--	1,491	2,730	2,065	1,217	549	4,171	105
Hackberry	105,177	--	15,874	15,813	15,105	14,385	10,629	25,566	7,805
Black cherry	1,173	--	192	227	363	258	133	--	--
Black walnut	47,133	--	11,917	10,816	10,629	5,810	3,397	4,564	--
Other hardwoods	45,631	--	6,496	8,608	7,179	5,528	5,411	7,738	4,671
Total hardwoods	794,314	--	87,831	103,253	94,902	91,435	82,157	210,797	123,939
All species	799,465	2,222	89,251	104,094	95,431	91,574	82,157	210,797	123,939

Table 14. -- Net volume of sawtimber on timberland by species group and diameter class, Kansas, 1994

(In thousand board feet)[1]

Species group	All classes	Diameter class (inches at breast height)							
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods									
Eastern redcedar	30,777	14,793	8,212	4,474	2,638	660	--	--	--
Total softwoods	30,777	14,793	8,212	4,474	2,638	660	--	--	--
Hardwoods									
Select white oak	554,661	--	51,718	66,670	50,835	64,180	59,853	182,471	78,934
Other white oak	100,820	--	28,959	28,806	16,436	11,324	7,082	8,213	--
Select red oak	302,736	--	39,438	43,757	34,053	36,317	32,097	86,308	30,766
Other red oak	165,792	--	22,186	24,756	22,256	22,507	15,871	49,934	8,282
Select hickory	104,302	--	20,167	20,995	18,403	11,778	18,550	9,452	4,957
Other hickory	46,748	--	19,546	9,051	7,818	4,913	2,286	3,134	--
Basswood	33,281	--	3,461	3,914	6,811	8,093	3,557	7,445	--
Hard maple	6,155	--	2,949	2,573	282	351	--	--	--
Soft maple	158,689	--	9,847	9,525	15,291	27,421	18,312	63,014	15,279
Elm	145,844	--	31,269	26,845	17,941	16,531	10,163	33,184	9,911
White & green ash	332,754	--	46,044	43,929	50,025	40,728	43,786	70,187	38,055
Sycamore	215,123	--	6,990	11,510	12,732	14,287	18,883	67,630	83,091
Cottonwood	1,025,850	--	40,821	78,156	72,695	87,221	102,779	330,706	313,472
Willow	64,914	--	9,092	14,775	10,763	6,171	2,767	20,785	561
Hackberry	591,424	--	105,288	92,314	83,361	77,238	56,351	134,646	42,226
Black cherry	6,995	--	1,329	1,367	2,094	1,467	738	--	--
Black walnut	272,853	--	76,643	62,667	59,018	31,684	18,322	24,519	--
Other hardwoods	237,583	--	39,268	46,325	36,490	26,927	26,640	38,304	23,142
Total hardwoods	4,366,524	--	555,015	587,935	517,304	489,625	438,037	1,129,932	648,676
All species	4,397,301	14,793	563,227	592,409	519,942	490,285	438,037	1,129,932	648,676

[1] International 1/4-inch rule.

Table 15. -- Net volume of sawtimber on timberland by species group, grade, diameter class, and Forest Survey Unit, Kansas, 1994

(In thousand board feet)[1]

Northeast Unit

Species group	Log grade 1					Log grade 2					Log grade 3					Log grade 4				
		Diameter class (inches at breast height)					Diameter class (inches at breast height)					Diameter class (inches at breast height)					Diameter class (inches at breast height)			
	Total	9.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	9.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	9.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	9.0-14.9	15.0-18.9	19.0-20.9	21.0+
Softwoods																				
Eastern redcedar	--	--	--	--	--	--	--	--	--	--	16,497	15,821	676	--	--	--	--	--	--	--
Total	--	--	--	--	--	--	--	--	--	--	16,497	15,821	676	--	--	--	--	--	--	--

Species group	Tree grade 1					Tree grade 2					Tree grade 3					Tree grade 4				
		Diameter class (inches at breast height)					Diameter class (inches at breast height)					Diameter class (inches at breast height)					Diameter class (inches at breast height)			
	Total	11.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	11.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	11.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	11.0-14.9	15.0-18.9	19.0-20.9	21.0+
Hardwoods																				
Select white oak	45,435	--	5,462	5,034	34,939	97,122	13,721	24,334	11,115	47,952	102,993	41,954	29,902	5,527	25,610	38,442	11,607	8,723	6,890	11,222
Other white oak	--	--	--	--	--	1,777	256	1,521	--	--	6,769	4,565	1,614	590	--	3,802	2,797	355	--	650
Select red oak	29,151	--	7,531	4,244	17,376	44,239	5,715	11,682	3,033	23,809	61,852	24,154	11,475	4,124	22,099	16,826	8,246	2,697	1,990	3,893
Other red oak	15,348	--	2,858	--	12,490	18,190	4,405	5,303	3,103	5,379	19,799	7,404	5,339	536	6,520	14,039	6,232	3,805	478	3,524
Select hickory	5,401	--	3,797	995	609	7,816	2,694	4,050	518	554	18,820	14,858	2,493	1,469	--	2,872	2,496	376	--	--
Other hickory	5,215	--	3,528	1,687	--	9,180	7,724	923	--	533	11,041	8,793	1,793	--	455	--	--	--	--	--
Basswood	13,912	--	11,837	885	1,190	7,780	1,816	1,127	--	4,837	10,703	4,673	1,940	2,672	1,418	--	--	--	--	--
Hard maple	--	--	--	--	--	1,618	985	633	--	--	1,488	1,488	--	--	--	--	--	--	--	--
Soft maple	22,442	--	5,417	2,009	15,016	16,303	3,640	1,614	4,804	6,245	19,087	4,749	7,657	365	6,316	3,455	254	816	--	2,385
Elm	4,729	--	2,021	707	2,001	12,133	5,655	1,470	784	4,224	24,858	13,039	4,230	2,754	4,835	10,321	6,930	2,588	803	--
White & green ash	28,720	740	8,526	4,604	14,850	26,512	8,486	10,666	2,287	5,073	16,212	13,053	1,722	816	621	3,031	2,058	973	--	--
Sycamore	92,330	--	11,592	7,774	72,964	14,001	5,474	3,635	2,056	2,836	7,983	3,664	1,519	--	2,800	2,058	--	778	1,280	--
Cottonwood	105,182	--	10,912	8,067	86,203	50,156	6,059	8,872	3,004	32,221	48,023	8,928	6,092	4,283	28,720	10,921	748	1,853	--	8,320
Willow	1,420	--	768	--	652	6,065	2,676	3,389	--	--	7,280	3,753	2,209	216	1,102	3,669	1,782	604	1,283	--
Hackberry	44,669	--	20,052	5,542	19,075	88,359	28,574	25,871	6,088	27,826	79,659	52,613	14,579	6,687	5,780	11,031	3,993	3,884	--	3,154
Black cherry	--	--	--	--	--	2,206	1,367	295	544	--	1,925	99	1,632	194	--	--	--	--	--	--
Black walnut	25,222	--	16,699	4,192	4,331	52,574	24,924	17,426	5,227	4,997	49,193	41,853	6,585	755	--	3,375	1,858	780	--	737
Other hardwoods	9,397	--	5,050	--	4,347	34,345	8,088	12,131	5,930	8,196	48,201	23,361	12,886	893	10,675	25,961	15,916	7,037	2,488	520
Total	448,573	740	116,050	45,740	286,043	490,376	132,259	134,942	48,493	174,682	535,886	273,001	114,053	31,881	116,951	149,803	64,917	35,269	15,212	34,405
All species	448,573	740	116,050	45,740	286,043	490,376	132,259	134,942	48,493	174,682	552,383	288,822	114,729	31,881	116,951	149,803	64,917	35,269	15,212	34,405

(Table 15 continued on next page)

(Table 15 continued)

Southeast Unit

Species group	Log grade 1					Log grade 2					Log grade 3					Log grade 4				
		Diameter class (inches at breast height)					Diameter class (inches at breast height)					Diameter class (inches at breast height)					Diameter class (inches at breast height)			
	Total	9.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	9.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	9.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	9.0-14.9	15.0-18.9	19.0-20.9	21.0+
Softwoods																				
Eastern redcedar	--	--	--	--	--	--	--	--	--	--	13,166	11,251	1,915	--	--	--	--	--	--	--
Total	--	--	--	--	--	--	--	--	--	--	13,166	11,251	1,915	--	--	--	--	--	--	--

Species group	Tree grade 1					Tree grade 2					Tree grade 3					Tree grade 4				
		Diameter class (inches at breast height)					Diameter class (inches at breast height)					Diameter class (inches at breast height)					Diameter class (inches at breast height)			
	Total	11.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	11.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	11.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	11.0-14.9	15.0-18.9	19.0-20.9	21.0+
Hardwoods																				
Select white oak	49,060	--	1,168	4,616	43,276	59,119	7,800	10,501	9,675	31,143	54,288	30,635	15,788	2,272	5,593	29,603	11,581	4,663	5,774	7,585
Other white oak	1,470	--	1,470	--	--	19,956	5,184	11,427	2,894	451	51,469	33,239	9,478	1,640	7,112	15,577	11,724	1,895	1,958	--
Select red oak	25,165	--	3,256	3,912	17,997	49,403	10,173	20,192	993	18,045	47,225	21,112	7,853	5,442	12,818	26,515	13,308	4,697	7,852	658
Other red oak	8,886	--	3,476	--	5,410	15,727	3,598	2,116	2,843	7,170	33,947	9,484	4,315	5,164	14,984	39,353	15,819	17,551	3,244	2,739
Select hickory	23,546	--	5,156	5,144	13,246	23,800	7,722	8,544	7,534	--	19,898	12,421	4,587	2,890	--	2,149	971	1,178	--	--
Other hickory	1,635	--	1,036	599	--	4,181	2,257	1,924	--	--	15,113	9,440	3,527	--	2,146	--	--	--	--	--
Basswood	--	--	--	--	--	310	310	--	--	--	576	576	--	--	--	--	--	--	--	--
Hard maple	--	--	--	--	--	861	861	--	--	--	2,188	2,188	--	--	--	--	--	--	--	--
Soft maple	24,017	--	9,504	2,338	12,175	25,993	3,784	8,910	6,033	7,266	20,465	6,418	6,543	439	7,065	11,631	--	1,082	2,324	8,225
Elm	1,033	--	648	385	--	12,866	3,445	4,624	--	4,797	30,508	12,267	3,762	2,829	11,650	17,535	6,986	4,612	478	5,459
White & green ash	70,782	645	17,859	17,246	35,032	45,015	12,915	18,890	8,017	5,193	43,423	23,122	8,483	2,778	9,040	5,516	2,393	3,123	--	--
Sycamore	60,370	--	5,087	3,877	51,406	13,285	5,037	3,209	--	5,039	5,640	3,260	--	1,559	821	10,312	--	1,199	2,337	6,776
Cottonwood	68,162	--	6,944	7,912	53,306	21,823	3,566	2,358	712	15,187	55,422	6,522	1,253	9,864	37,783	14,381	4,099	--	759	9,523
Willow	7,641	--	2,269	--	5,372	6,879	3,692	2,626	--	561	14,594	7,458	4,721	520	1,895	1,146	398	--	748	--
Hackberry	71,892	--	25,151	10,314	36,427	106,361	25,145	30,834	8,307	42,075	94,555	61,861	12,917	8,384	11,393	10,567	5,395	4,214	--	958
River birch	--	--	--	--	--	--	--	--	--	--	2,928	942	--	855	1,131	--	--	--	--	--
Black cherry	--	--	--	--	--	--	--	--	--	--	1,843	613	1,230	--	--	1,021	617	404	--	--
Black walnut	27,306	--	16,204	4,180	6,922	54,808	27,227	19,493	2,219	5,869	43,523	36,045	7,045	433	--	3,479	2,756	--	--	723
Other hardwoods	5,534	--	1,247	--	4,287	25,490	4,667	6,340	4,434	10,049	32,388	16,190	6,203	2,231	7,764	8,068	3,317	2,666	566	1,519
Total	446,499	645	100,475	60,523	284,856	485,877	127,383	151,988	53,661	152,845	569,993	293,793	97,705	47,300	131,195	196,853	79,364	47,284	26,040	44,165
All species	446,499	645	100,475	60,523	284,856	485,877	127,383	151,988	53,661	152,845	583,159	305,044	99,620	47,300	131,195	196,853	79,364	47,284	26,040	44,165

(Table 15 continued on next page)

(Table 15 continued)

West Unit

Species group	Log grade 1					Log grade 2					Log grade 3					Log grade 4				
		Diameter class (inches at breast height)					Diameter class (inches at breast height)					Diameter class (inches at breast height)					Diameter class (inches at breast height)			
	Total	9.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	9.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	9.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	9.0-14.9	15.0-18.9	19.0-20.9	21.0+
Softwoods																				
Eastern redcedar	--	--	--	--	--	--	--	--	--	--	1,114	407	707	--	--	--	--	--	--	--
Total	--	--	--	--	--	--	--	--	--	--	1,114	407	707	--	--	--	--	--	--	--

Species group	Tree grade 1					Tree grade 2					Tree grade 3					Tree grade 4				
		Diameter class (inches at breast height)					Diameter class (inches at breast height)					Diameter class (inches at breast height)					Diameter class (inches at breast height)			
	Total	11.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	11.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	11.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	11.0-14.9	15.0-18.9	19.0-20.9	21.0+
Hardwoods																				
Select white oak	25,725	--	1,710	3,895	20,120	29,874	656	2,584	3,200	23,434	14,311	434	5,344	1,855	6,678	7,650	--	4,836	--	2,814
Other white oak	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Select red oak	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Other red oak	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Select hickory	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Other hickory	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Basswood	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hard maple	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Soft maple	7,349	--	--	--	7,349	--	--	--	--	--	--	--	--	--	--	7,028	--	777	--	6,251
Elm	3,196	--	1,773	1,423	--	12,706	1,802	1,686	--	9,218	10,633	5,423	4,299	--	911	5,326	2,567	2,759	--	--
White & green ash	24,346	--	7,411	1,908	15,027	32,093	6,722	9,945	4,511	10,915	31,390	18,301	2,211	1,222	9,656	1,186	1,186	--	--	--
Sycamore	1,988	--	--	--	1,988	--	--	--	--	--	549	549	--	--	--	--	--	--	--	--
Cottonwood	269,607	--	42,503	25,565	201,539	185,130	36,486	47,907	25,871	74,866	174,886	44,067	25,779	15,535	89,505	22,157	8,502	5,443	1,207	7,005
Willow	4,653	--	--	--	4,653	348	--	348	--	--	8,920	1,809	--	--	7,111	2,299	2,299	--	--	--
Hackberry	34,484	--	6,701	7,221	20,562	24,885	9,342	9,605	790	5,148	19,845	10,354	5,103	2,439	1,949	2,319	325	611	--	1,383
Black cherry	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Black walnut	1,858	--	1,425	433	--	4,329	974	2,472	883	--	5,142	3,307	1,835	--	--	2,044	366	738	--	940
Other hardwoods	979	--	979	--	--	19,353	2,565	3,515	2,740	10,533	16,816	5,559	4,509	5,394	1,354	7,607	4,988	439	1,109	1,071
Total	374,185	--	62,502	40,445	271,238	308,718	58,547	78,062	37,995	134,114	282,492	89,803	49,080	26,445	117,164	57,616	20,233	15,603	2,316	19,464
All species	374,185	--	62,502	40,445	271,238	308,718	58,547	78,062	37,995	134,114	283,606	90,210	49,787	26,445	117,164	57,616	20,233	15,603	2,316	19,464

(Table 15 continued on next page)

(Table 15 continued)

All Units

Species group	Log grade 1					Log grade 2					Log grade 3					Log grade 4				
		Diameter class (inches at breast height)					Diameter class (inches at breast height)					Diameter class (inches at breast height)					Diameter class (inches at breast height)			
	Total	9.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	9.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	9.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	9.0-14.9	15.0-18.9	19.0-20.9	21.0+
Softwoods																				
Eastern redcedar	--	--	--	--	--	--	--	--	--	--	30,777	27,479	3,298	--	--	--	--	--	--	--
Total	--	--	--	--	--	--	--	--	--	--	30,777	27,479	3,298	--	--	--	--	--	--	--
Hardwoods																				
Select white oak	120,220	--	8,340	13,545	98,335	186,115	22,177	37,419	23,990	102,529	171,592	73,023	51,034	9,654	37,881	75,695	23,188	18,222	12,664	21,621
Other white oak	1,470	--	1,470	--	--	21,733	5,440	12,948	2,894	451	58,238	37,804	11,092	2,230	7,112	19,379	14,521	2,250	1,958	650
Select red oak	54,316	--	10,787	8,156	35,373	93,642	15,888	31,874	4,026	41,854	109,077	45,266	19,328	9,566	34,917	43,341	21,554	7,394	9,842	4,551
Other red oak	24,234	--	6,334	--	17,900	33,917	8,003	7,419	5,946	12,549	53,746	16,888	9,654	5,700	21,504	53,392	22,051	21,356	3,722	6,263
Select hickory	28,947	--	8,953	6,139	13,855	31,616	10,416	12,594	8,052	554	38,718	27,279	7,080	4,359	--	5,021	3,467	1,554	--	--
Other hickory	6,850	--	4,564	2,286	--	13,361	9,981	2,847	--	533	26,154	18,233	5,320	--	2,601	--	--	--	--	--
Basswood	13,912	--	11,837	885	1,190	8,090	2,126	1,127	--	4,837	11,279	5,249	1,940	2,672	1,418	--	--	--	--	--
Hard maple	--	--	--	--	--	2,479	1,846	633	--	--	3,676	3,676	--	--	--	--	--	--	--	--
Soft maple	53,808	--	14,921	4,347	34,540	42,296	7,424	10,524	10,837	13,511	39,552	11,167	14,200	804	13,381	22,114	254	2,675	2,324	16,861
Elm	8,958	--	4,442	2,515	2,001	37,705	10,902	7,780	784	18,239	65,999	30,729	12,291	5,583	17,396	33,182	16,483	9,959	1,281	5,459
Black ash	--	--	--	--	--	--	--	--	--	--	873	--	873	--	--	--	--	--	--	--
White & green ash	123,848	1,385	33,796	23,758	64,909	103,620	28,123	39,501	14,815	21,181	91,025	54,476	12,416	4,816	19,317	9,733	5,637	4,096	--	--
Sycamore	154,688	--	16,679	11,651	126,358	27,286	10,511	6,844	2,056	7,875	14,172	7,473	1,519	1,559	3,621	12,370	--	1,977	3,617	6,776
Cottonwood	442,951	--	60,359	41,544	341,048	257,109	46,111	59,137	29,587	122,274	278,331	59,517	33,124	29,682	156,008	47,459	13,349	7,296	1,966	24,848
Willow	13,714	--	3,037	--	10,677	13,292	6,368	6,363	--	561	30,794	13,020	6,930	736	10,108	7,114	4,479	604	2,031	--
Hackberry	151,045	--	51,904	23,077	76,064	219,605	63,061	66,310	15,185	75,049	194,059	124,828	32,599	17,510	19,122	23,917	9,713	8,709	--	5,495
River birch	--	--	--	--	--	--	--	--	--	--	2,928	942	--	855	1,131	--	--	--	--	--
Black cherry	--	--	--	--	--	2,206	1,367	295	544	--	3,768	712	2,862	194	--	1,021	617	404	--	--
Black walnut	54,386	--	34,328	8,805	11,253	111,711	53,125	39,391	8,329	10,866	97,858	81,205	15,465	1,188	--	8,898	4,980	1,518	--	2,400
Other hardwoods	15,910	--	7,276	--	8,634	79,188	15,320	21,986	13,104	28,778	96,532	45,110	23,111	8,518	19,793	41,636	24,221	10,142	4,163	3,110
Total	1,269,257	1,385	279,027	146,708	842,137	1,284,971	318,189	364,992	140,149	461,641	1,388,371	656,597	260,838	105,626	365,310	404,272	164,514	98,156	43,568	98,034
All species	1,269,257	1,385	279,027	146,708	842,137	1,284,971	318,189	364,992	140,149	461,641	1,419,148	684,076	264,136	105,626	365,310	404,272	164,514	98,156	43,568	98,034

Species group	Tree grade 1					Tree grade 2					Tree grade 3					Tree grade 4				
		Diameter class (inches at breast height)					Diameter class (inches at breast height)					Diameter class (inches at breast height)					Diameter class (inches at breast height)			
	Total	11.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	11.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	11.0-14.9	15.0-18.9	19.0-20.9	21.0+	Total	11.0-14.9	15.0-18.9	19.0-20.9	21.0+
Hardwoods																				
Select white oak	120,220	--	8,340	13,545	98,335	186,115	22,177	37,419	23,990	102,529	171,592	73,023	51,034	9,654	37,881	75,695	23,188	18,222	12,664	21,621
Other white oak	1,470	--	1,470	--	--	21,733	5,440	12,948	2,894	451	58,238	37,804	11,092	2,230	7,112	19,379	14,521	2,250	1,958	650
Select red oak	54,316	--	10,787	8,156	35,373	93,642	15,888	31,874	4,026	41,854	109,077	45,266	19,328	9,566	34,917	43,341	21,554	7,394	9,842	4,551
Other red oak	24,234	--	6,334	--	17,900	33,917	8,003	7,419	5,946	12,549	53,746	16,888	9,654	5,700	21,504	53,392	22,051	21,356	3,722	6,263
Select hickory	28,947	--	8,953	6,139	13,855	31,616	10,416	12,594	8,052	554	38,718	27,279	7,080	4,359	--	5,021	3,467	1,554	--	--
Other hickory	6,850	--	4,564	2,286	--	13,361	9,981	2,847	--	533	26,154	18,233	5,320	--	2,601	--	--	--	--	--
Basswood	13,912	--	11,837	885	1,190	8,090	2,126	1,127	--	4,837	11,279	5,249	1,940	2,672	1,418	--	--	--	--	--
Hard maple	--	--	--	--	--	2,479	1,846	633	--	--	3,676	3,676	--	--	--	--	--	--	--	--
Soft maple	53,808	--	14,921	4,347	34,540	42,296	7,424	10,524	10,837	13,511	39,552	11,167	14,200	804	13,381	22,114	254	2,675	2,324	16,861
Elm	8,958	--	4,442	2,515	2,001	37,705	10,902	7,780	784	18,239	65,999	30,729	12,291	5,583	17,396	33,182	16,483	9,959	1,281	5,459
Black ash	--	--	--	--	--	--	--	--	--	--	873	--	873	--	--	--	--	--	--	--
White & green ash	123,848	1,385	33,796	23,758	64,909	103,620	28,123	39,501	14,815	21,181	91,025	54,476	12,416	4,816	19,317	9,733	5,637	4,096	--	--
Sycamore	154,688	--	16,679	11,651	126,358	27,286	10,511	6,844	2,056	7,875	14,172	7,473	1,519	1,559	3,621	12,370	--	1,977	3,617	6,776
Cottonwood	442,951	--	60,359	41,544	341,048	257,109	46,111	59,137	29,587	122,274	278,331	59,517	33,124	29,682	156,008	47,459	13,349	7,296	1,966	24,848
Willow	13,714	--	3,037	--	10,677	13,292	6,368	6,363	--	561	30,794	13,020	6,930	736	10,108	7,114	4,479	604	2,031	--
Hackberry	151,045	--	51,904	23,077	76,064	219,605	63,061	66,310	15,185	75,049	194,059	124,828	32,599	17,510	19,122	23,917	9,713	8,709	--	5,495
River birch	--	--	--	--	--	--	--	--	--	--	2,928	942	--	855	1,131	--	--	--	--	--
Black cherry	--	--	--	--	--	2,206	1,367	295	544	--	3,768	712	2,862	194	--	1,021	617	404	--	--
Black walnut	54,386	--	34,328	8,805	11,253	111,711	53,125	39,391	8,329	10,866	97,858	81,205	15,465	1,188	--	8,898	4,980	1,518	--	2,400
Other hardwoods	15,910	--	7,276	--	8,634	79,188	15,320	21,986	13,104	28,778	96,532	45,110	23,111	8,518	19,793	41,636	24,221	10,142	4,163	3,110
Total	1,269,257	1,385	279,027	146,708	842,137	1,284,971	318,189	364,992	140,149	461,641	1,388,371	656,597	260,838	105,626	365,310	404,272	164,514	98,156	43,568	98,034
All species	1,269,257	1,385	279,027	146,708	842,137	1,284,971	318,189	364,992	140,149	461,641	1,419,148	684,076	264,136	105,626	365,310	404,272	164,514	98,156	43,568	98,034

[1] International 1/4-inch rule.

Table 16. -- Net volume of growing stock and sawtimber on timberland by Forest Survey Unit, county/county group, and major species group, Kansas, 1994

Forest Survey Unit and county/county group	Growing stock				Sawtimber			
		Major species group				Major species group		
	All species	Softwoods	Soft hardwoods	Hard hardwoods	All species	Softwoods	Soft hardwoods	Hard hardwoods
	(In thousand cubic feet)				(In thousand board feet) [1]			
Northeastern								
Atchison	23,671	14	8,977	14,680	85,039	--	32,386	52,653
Clay Center [2]	32,942	1,263	19,137	12,542	115,213	2,238	64,327	48,648
Doniphan	29,920	19	10,962	18,939	105,794	--	38,586	67,208
Douglas	22,481	476	8,247	13,758	71,697	1,128	28,338	42,231
Franklin	22,056	458	8,223	13,375	69,866	1,078	28,301	40,487
Jackson	19,645	290	9,932	9,423	67,372	648	34,771	31,953
Jefferson	40,351	23	16,373	23,955	143,983	--	59,560	84,423
Johnson-Wyandotte	29,140	608	10,634	17,898	92,673	1,405	36,816	54,452
Leavenworth	36,689	21	14,861	21,807	130,892	--	54,055	76,837
Marshall	23,516	376	12,229	10,911	80,161	627	43,078	36,456
Miami	38,370	835	13,929	23,606	123,001	1,924	48,596	72,481
Nemaha-Brown	26,779	420	13,854	12,505	92,993	744	49,936	42,313
Osage	29,274	604	10,748	17,922	92,825	1,399	37,134	54,292
Pottawatomie	28,964	456	14,626	13,882	98,062	900	50,601	46,561
Riley-Geary	40,677	1,967	22,802	15,908	143,822	3,200	79,771	60,851
Shawnee	17,604	271	8,917	8,416	60,403	590	31,292	28,521
Wabaunsee	21,387	313	11,029	10,045	72,780	616	38,237	33,927
Total	483,466	8,414	215,480	259,572	1,646,576	16,497	755,785	874,294
Southeastern								
Anderson	21,372	902	6,056	14,414	66,813	1,572	20,030	45,211
Bourbon	36,635	1,632	10,071	24,932	113,917	2,842	32,976	78,099
Butler	15,373	9	7,309	8,055	50,869	28	30,383	20,458
Chautauqua	32,206	27	11,790	20,389	101,013	82	45,754	55,177
Cherokee	35,936	274	15,537	20,125	118,867	490	54,964	63,413
Coffey	23,091	71	11,586	11,434	87,671	--	44,380	43,291
Cowley	16,458	11	7,361	9,086	53,927	34	30,211	23,682
Crawford	33,595	260	14,285	19,050	110,359	460	49,642	60,257
Elk	19,529	16	7,584	11,929	62,003	47	29,960	31,996
Emporia [3]	66,864	184	33,092	33,588	256,532	--	127,370	129,162
Greenwood	18,780	13	8,063	10,704	60,830	40	32,729	28,061
Labette	28,134	219	12,222	15,693	91,989	373	42,651	48,965
Linn	47,370	2,144	12,929	32,297	146,787	3,735	42,155	100,897
Montgomery	36,768	274	15,549	20,945	119,821	483	52,176	67,162
Neosho	23,281	181	10,201	12,899	76,084	305	35,649	40,130
Wilson	35,136	268	14,407	20,461	112,402	483	47,839	64,080
Woodson-Allen	30,848	1,258	8,854	20,736	96,716	2,192	29,370	65,154
Total	521,376	7,743	206,896	306,737	1,726,600	13,166	748,239	965,195
Western								
Colby-Garden City-Dodge City [4]	25,573	77	24,874	621	121,580	407	118,156	3,017
Great Bend-Hutchinson [5]	25,778	129	20,007	5,642	99,553	259	84,766	14,528
Hays [6]	60,398	--	46,661	13,737	239,395	--	192,025	47,370
Jewell-Mitchell	35,497	--	24,674	10,823	144,547	--	104,815	39,732
Republic-Cloud	33,647	--	23,136	10,511	136,921	--	98,346	38,575
Salina [7]	31,173	--	21,343	9,830	126,614	--	90,648	35,966
Wichita [8]	38,416	224	30,230	7,963	155,515	448	131,799	23,268
Total	250,482	430	190,925	59,127	1,024,125	1,114	820,555	202,456
All counties	1,255,324	16,587	613,301	625,436	4,397,301	30,777	2,324,579	2,041,945

[1] International 1/4-inch rule.

[2] Includes: Clay, Dickinson, and Washington counties.

[3] Includes: Chase, Lyon, Marion, and Morris counties.

[4] Includes: Cheyenne, Clark, Comanche, Decatur, Finney, Ford, Gove, Grant, Gray, Greeley, Hamilton, Haskell, Hodgeman, Kearny, Kiowa, Lane, Logan, Meade, Morton, Ness, Rawlins, Scott, Seward, Sheridan, Sherman, Stanton, Stevens, Thomas, Wallace, and Wichita counties.

[5] Includes: Barton, Edwards, Harvey, McPherson, Pawnee, Reno, Rice, Rush, and Stafford counties.

[6] Includes: Ellis, Graham, Norton, Osborne, Phillips, Rooks, Russell, Smith, and Trego counties.

[7] Includes: Ellsworth, Lincoln, Ottawa, and Saline counties.

[8] Includes: Barber, Harper, Kingman, Pratt, Sedgwick, and Sumner counties.

Table 17. -- Net volume of all live trees and salvable dead trees on timberland by class of timber and major species group, Kansas, 1994

(In thousand cubic feet)

Class of timber	All species	Major species group		
		Softwoods	Soft hardwoods	Hard hardwoods
Live trees				
Growing stock trees				
Sawtimber				
Saw-log portion	799,465	5,151	429,081	365,233
Upper-stem portion	100,839	819	44,713	55,307
Total	900,304	5,970	473,794	420,540
Poletimber	355,020	10,617	139,507	204,896
All growing-stock trees	1,255,324	16,587	613,301	625,436
Cull trees				
Short-log trees	168,821	332	90,755	77,734
Rough trees [1]				
Sawtimber size	275,941	2,761	124,039	149,141
Poletimber size	180,820	2,048	80,989	97,783
Total	456,761	4,809	205,028	246,924
Rotten trees [1]				
Sawtimber size	70,292	145	41,138	29,009
Poletimber size	8,269	--	4,917	3,352
Total	78,561	145	46,055	32,361
All cull trees	704,143	5,286	341,838	357,019
All live trees	1,959,467	21,873	955,139	982,455
Salvable dead trees				
Sawtimber size	37,991	--	24,499	13,492
Poletimber size	21,531	--	12,087	9,444
All salvable dead trees	59,522	--	36,586	22,936
All classes	2,018,989	21,873	991,725	1,005,391

[1] Includes noncommercial species.

Table 18. -- Net volume of all live trees and growing stock on timberland by ownership class and major species group, Kansas, 1994

(In thousand cubic feet)

Ownership class	All live trees				Growing stock			
		Major species group				Major species group		
	All species	Softwoods	Soft hardwoods	Hard hardwoods	All species	Softwoods	Soft hardwoods	Hard hardwoods
Federal	56,169	409	27,412	28,348	33,969	377	16,873	16,719
State	42,064	138	25,287	16,639	29,591	--	18,063	11,528
County and municipal	7,930	132	3,115	4,683	4,740	132	1,960	2,648
Indian	1,077	73	730	274	928	73	696	159
Corporate	95,850	214	43,539	52,097	59,907	214	25,378	34,315
Individual	1,756,377	20,907	855,056	880,414	1,126,189	15,791	550,331	560,067
All ownerships	1,959,467	21,873	955,139	982,455	1,255,324	16,587	613,301	625,436

Table 19. -- Net volume of growing stock on timberland by forest type group/local type and major species group, Kansas, 1994

(In thousand cubic feet)

Forest type group/ local type	All species	Major species group		
		Softwoods	Soft hardwoods	Hard hardwoods
Eastern redcedar				
Eastern redcedar	5,766	4,832	91	843
Eastern redcedar-hardwood	14,489	5,660	3,684	5,145
Total	20,255	10,492	3,775	5,988
Oak-hickory				
Red oak-white oak-hickory	229,662	1,303	24,240	204,119
Bur oak	14,715	114	998	13,603
Post-blackjack oak	58,602	550	2,074	55,978
Total	302,979	1,967	27,312	273,700
Elm-ash-cottonwood				
Cottonwood	119,329	--	118,119	1,210
Elm-ash-cottonwood	174,667	206	116,826	57,635
Willow	1,086	60	976	50
Total	295,082	266	235,921	58,895
Maple-beech-birch				
Lowland plains hardwoods	290,743	1,653	161,838	127,252
Total	290,743	1,653	161,838	127,252
Elm-ash-locust				
Elm-ash-locust	346,078	2,209	184,268	159,601
Total	346,078	2,209	184,268	159,601
Nonstocked	187	--	187	--
All forest types	1,255,324	16,587	613,301	625,436

Table 20. -- Average annual net growth of growing stock and sawtimber on timberland by Forest Survey Unit, county/county group, and major species group, Kansas, 1981-1993

Forest Survey Unit and county/county group	Growing stock				Sawtimber			
		Major species group				Major species group		
	All species	Softwoods	Soft hardwoods	Hard hardwoods	All species	Softwoods	Soft hardwoods	Hard hardwoods
	(In thousand cubic feet)				*(In thousand board feet)* [1]			
Northeastern								
Atchison	438	--	202	236	2,295	--	760	1,535
Clay Center [2]	937	3	754	180	3,183	4	2,346	833
Doniphan	519	--	303	216	2,301	--	1,285	1,016
Douglas	533	28	237	268	1,879	92	829	958
Franklin	737	48	400	289	2,490	124	1,065	1,301
Jackson	866	19	467	380	3,176	18	1,568	1,590
Jefferson	709	3	346	360	3,180	--	1,516	1,664
Johnson-Wyandotte	861	10	260	591	3,357	--	852	2,505
Leavenworth	865	--	371	494	3,016	--	697	2,319
Marshall	755	73	451	231	2,499	78	1,762	659
Miami	855	32	279	544	2,347	21	827	1,499
Nemaha-Brown	476	12	208	256	1,572	--	282	1,290
Osage	800	35	402	363	2,647	93	1,387	1,167
Pottawatomie	388	31	122	235	1,087	47	262	778
Riley-Geary	627	129	311	187	1,557	107	621	829
Shawnee	656	--	490	166	1,841	--	1,343	498
Wabaunsee	289	23	201	65	689	16	588	85
Total	11,311	446	5,804	5,061	39,116	600	17,990	20,526
Southeastern								
Anderson	419	85	249	85	1,066	77	786	203
Bourbon	879	146	307	426	3,082	49	1,471	1,562
Butler	418	--	281	137	1,132	--	993	139
Chautauqua	662	--	54	608	1,665	--	199	1,466
Cherokee	2,044	11	1,041	992	6,917	--	4,397	2,520
Coffey	727	11	451	265	2,015	118	1,085	812
Cowley	245	--	145	100	1,068	--	769	299
Crawford	477	--	315	162	1,638	--	1,253	385
Elk	482	--	79	403	1,701	--	383	1,318
Emporia [3]	730	-3	431	302	2,925	--	1,609	1,316
Greenwood	617	5	293	319	1,538	18	877	643
Labette	77	15	63	-1	664	44	523	97
Linn	1,252	126	324	802	4,047	176	687	3,184
Montgomery	856	20	266	570	3,999	20	757	3,222
Neosho	631	15	281	335	1,868	93	627	1,148
Wilson	974	58	392	524	2,938	19	1,659	1,260
Woodson-Allen	895	61	276	558	2,407	--	901	1,506
Total	12,385	550	5,248	6,587	40,670	614	18,976	21,080
Western								
Colby-Garden City-Dodge City [4]	-7	3	-32	22	338	33	344	-39
Great Bend-Hutchinson [5]	182	--	146	36	1,000	--	839	161
Hays [6]	414	--	190	224	1,900	--	1,502	398
Jewell-Mitchell	257	--	261	-4	591	--	479	112
Republic-Cloud	422	--	363	59	2,614	--	2,495	119
Salina [7]	363	--	--	363	1,907	--	152	1,755
Wichita [8]	448	45	220	183	2,155	--	1,451	704
Total	2,079	48	1,148	883	10,505	33	7,262	3,210
All counties	25,775	1,044	12,200	12,531	90,291	1,247	44,228	44,816

[1] International 1/4-inch rule.

[2] Includes: Clay, Dickinson, and Washington counties.

[3] Includes: Chase, Lyon, Marion, and Morris counties.

[4] Includes: Cheyenne, Clark, Comanche, Decatur, Finney, Ford, Gove, Grant, Gray, Greeley, Hamilton, Haskell, Hodgeman, Kearny, Kiowa, Lane, Logan, Meade, Morton, Ness, Rawlins, Scott, Seward, Sheridan, Sherman, Stanton, Stevens, Thomas, Wallace, and Wichita counties.

[5] Includes: Barton, Edwards, Harvey, McPherson, Pawnee, Reno, Rice, Rush, and Stafford counties.

[6] Includes: Ellis, Graham, Norton, Osborne, Phillips, Rooks, Russell, Smith, and Trego counties.

[7] Includes: Ellsworth, Lincoln, Ottawa, and Saline counties.

[8] Includes: Barber, Harper, Kingman, Pratt, Sedgwick, and Sumner counties.

Table 21. -- Average annual removals of growing stock and sawtimber on timberland by Forest Survey Unit, county/county group, and major species group, Kansas, 1981-1993

Forest Survey Unit and county/county group	Growing stock				Sawtimber			
		Major species group				Major species group		
	All species	Softwoods	Soft hardwoods	Hard hardwoods	All species	Softwoods	Soft hardwoods	Hard hardwoods
	(In thousand cubic feet)				(In thousand board feet) [1]			
Northeastern								
Atchison	386	--	124	262	1,529		544	985
Clay Center [2]	44	--	27	17	169	--	81	88
Doniphan	481	--	176	305	2,121	--	715	1,406
Douglas	246	9	77	160	847	--	231	616
Franklin	344	--	268	76	1,374	--	1,039	335
Jackson	492	--	243	249	1,863	--	934	929
Jefferson	255	--	86	169	834	--	201	633
Johnson-Wyandotte	371	--	69	302	1,133	--	--	1,133
Leavenworth	500	--	39	461	2,080	--	72	2,008
Marshall	295	28	90	177	691	--	272	419
Miami	388	--	12	376	1,219	--	--	1,219
Nemaha-Brown	184	--	170	14	786	--	709	77
Osage	180	--	133	47	318	--	318	--
Pottawatomie	241	--	194	47	742	--	625	117
Riley-Geary	115	--	38	77	518	--	151	367
Shawnee	196	--	189	7	866	--	866	--
Wabaunsee	92	--	42	50	252	--	102	150
Total	4,810	37	1,977	2,796	17,342	--	6,860	10,482
Southeastern								
Anderson	92	--	49	43	107	--	51	56
Bourbon	120	--	67	53	--	--	--	--
Butler	250	--	124	126	1,165	--	598	567
Chautauqua	156	--	99	57	523	--	466	57
Cherokee	172	--	43	129	704	--	99	605
Coffey	13	--	--	13	61	--	--	61
Cowley	--	--	--	--	--	--	--	--
Crawford	163	--	25	138	705	--	117	588
Elk	12	--	--	12	--	--	--	--
Emporia [3]	335	--	215	120	1,363	--	918	445
Greenwood	113	--	28	85	525	--	145	380
Labette	9	--	9	--	--	--	--	--
Linn	299	42	39	218	751	75	105	646
Montgomery	28	--	28	--	129	--	129	--
Neosho	60	--	--	60	193	--	--	193
Wilson	83	--	28	55	351	--	133	218
Woodson-Allen	175	--	70	105	809	--	357	452
Total	2,080	42	824	1,214	7,461	75	3,118	4,268
Western								
Colby-Garden City-Dodge City [4]	213	--	183	30	1,044	--	913	131
Great Bend-Hutchinson [5]	--	--	--	--	--	--	--	--
Hays [6]	--	--	--	--	--	--	--	--
Jewell-Mitchell	--	--	--	--	--	--	--	--
Republic-Cloud	--	--	--	--	--	--	--	--
Salina [7]	621	--	535	86	3,080	--	2,691	389
Wichita [8]	337	--	256	81	1,116	--	990	126
Total	1,171	--	974	197	5,240	--	4,594	646
All counties	8,061	79	3,775	4,207	30,043	75	14,572	15,396

[1] International 1/4-inch rule.

[2] Includes: Clay, Dickinson, and Washington counties.

[3] Includes: Chase, Lyon, Marion, and Morris counties.

[4] Includes: Cheyenne, Clark, Comanche, Decatur, Finney, Ford, Gove, Grant, Gray, Greeley, Hamilton, Haskell, Hodgeman, Kearny, Kiowa, Lane, Logan, Meade, Morton, Ness, Rawlins, Scott, Seward, Sheridan, Sherman, Stanton, Stevens, Thomas, Wallace, and Wichita counties.

[5] Includes: Barton, Edwards, Harvey, McPherson, Pawnee, Reno, Rice, Rush, and Stafford counties.

[6] Includes: Ellis, Graham, Norton, Osborne, Phillips, Rooks, Russell, Smith, and Trego counties.

[7] Includes: Ellsworth, Lincoln, Ottawa, and Saline counties.

[8] Includes: Barber, Harper, Kingman, Pratt, Sedgwick, and Sumner counties.

Table 22. -- Average annual net growth and average annual removals of growing stock and sawtimber on timberland by species group, Kansas, 1981-1993

Species group	Growing stock		Sawtimber	
	Average annual net growth	Average annual removals	Average annual net growth	Average annual removals
	(In thousand cubic feet)		*(In thousand board feet)* [1]	
Softwoods				
Eastern redcedar	1,044	79	1,247	75
Total softwoods	1,044	79	1,247	75
Hardwoods				
Select white oak	1,462	498	7,586	2,313
Other white oak	1,132	111	2,789	304
Select red oak	1,393	481	6,743	2,168
Other red oak	1,192	435	3,463	1,781
Select hickory	584	293	1,490	1,184
Other hickory	484	103	1,516	108
Basswood	144	57	571	322
Hard maple	34	--	105	--
Soft maple	942	400	4,293	1,648
Elm	1,442	546	1,540	1,170
White & green ash	2,495	375	7,898	1,118
Sycamore	473	18	2,502	97
Cottonwood	1,610	1,310	11,124	6,200
Willow	271	302	2,242	1,173
Hackberry	6,855	989	21,662	3,577
Black cherry	107	--	191	--
Black walnut	2,339	1,052	8,959	3,991
Other hardwoods	1,772	1,012	5,580	2,814
Total hardwoods	24,731	7,982	90,254	29,968
All species	25,775	8,061	91,501	30,043

[1] International 1/4-inch rule.

Table 23. -- Average annual mortality of growing stock and sawtimber on timberland by species group, Kansas, 1981-1993

Species group	Growing stock average annual mortality	Sawtimber average annual mortality
	(In thousand cubic feet)	*(In thousand board feet)* [1]
Softwoods		
Eastern redcedar	56	71
Total softwoods	56	71
Hardwoods		
Select white oak	1,088	4,117
Other white oak	291	420
Select red oak	815	3,228
Other red oak	772	2,290
Select hickory	578	1,303
Other hickory	194	355
Basswood	96	314
Hard maple	23	51
Soft maple	708	2,718
Elm	4,050	10,317
White & green ash	1,560	3,854
Sycamore	487	2,012
Cottonwood	4,373	16,790
Willow	471	1,447
Hackberry	1,791	5,198
Black cherry	85	106
Black walnut	680	1,182
Other hardwoods	2,047	4,728
Total hardwoods	20,109	60,430
All species	20,165	60,501

[1] International 1/4-inch rule.

Table 24. -- Average annual net growth and average annual removals of growing stock and sawtimber on timberland by ownership class and major species group, Kansas, 1981-1993

Ownership class	All species	Softwoods	Soft hardwoods	Hard hardwoods
	Average annual net growth of growing stock			
		Major species group		
	(In thousand cubic feet)			
Federal	657	23	327	307
State	1,010	--	676	334
County and municipal	120	4	60	56
Indian	39	5	25	9
Corporate	1,372	47	521	804
Individual	22,577	965	10,591	11,021
All ownerships	25,775	1,044	12,200	12,531
	Average annual removals of growing stock			
		Major species group		
	(In thousand cubic feet)			
Federal	33	--	18	15
State	--	--	--	--
County and municipal	--	--	--	--
Indian	75	--	29	46
Corporate	293	--	89	204
Individual	7,660	79	3,639	3,942
All ownerships	8,061	79	3,775	4,207
	Average annual net growth of sawtimber			
		Major species group		
	(In thousand board feet) [1]			
Federal	1,886	-2	849	1,039
State	3,004	--	2,184	820
County and municipal	456	20	305	131
Indian	169	16	128	25
Corporate	4,558	--	1,562	2,996
Individual	81,428	1,213	39,750	40,465
All ownerships	91,501	1,247	44,778	45,476
	Average annual removals of sawtimber			
		Major species group		
	(In thousand board feet) [1]			
Federal	161	--	87	74
State	--	--	--	--
County and municipal	--	--	--	--
Indian	341	--	137	204
Corporate	1,048	--	369	679
Individual	28,493	75	13,979	14,439
All ownerships	30,043	75	14,572	15,396

[1] International 1/4-inch rule.

Table 25. -- Average annual net growth and average annual removals of growing stock and sawtimber on timberland by forest type group/local type and major species group, Kansas, 1981-1993

Forest type group/ local type	Average annual net growth of growing stock				Average annual removals of growing stock			
		Major species group				Major species group		
	All species	Softwoods	Soft hardwoods	Hard hardwoods	All species	Softwoods	Soft hardwoods	Hard hardwoods
	(In thousand cubic feet)				*(In thousand cubic feet)*			
Eastern redcedar								
Eastern redcedar	501	410	18	73	48	36	12	--
Eastern redcedar-hardwood	638	303	146	189	39	--	32	7
Total	1,139	713	164	262	87	36	44	7
Oak-hickory								
Red oak-white oak-hickory	4,343	52	742	3,549	1,285	7	95	1,183
Bur oak	147	--	10	137	77	--	7	70
Post-blackjack oak	1,761	20	98	1,643	168	--	26	142
Total	6,251	72	850	5,329	1,530	7	128	1,395
Elm-ash-cottonwood								
Cottonwood	1,220	--	1,192	28	1,074	--	1,033	41
Elm-ash-cottonwood	3,248	9	2,208	1,031	1,050	--	739	311
Willow	47	5	44	-2	--	--	--	--
Total	4,515	14	3,444	1,057	2,124	--	1,772	352
Maple-beech-birch								
Lowland plains hardwoods	6,997	99	4,284	2,614	2,006	3	941	1,062
Total	6,997	99	4,284	2,614	2,006	3	941	1,062
Elm-ash-locust								
Elm-ash-locust	6,873	146	3,449	3,278	2,314	33	890	1,391
Total	6,873	146	3,449	3,278	2,314	33	890	1,391
Nonstocked	--	--	9	-9	--	--	--	--
All forest types	25,775	1,044	12,200	12,531	8,061	79	3,775	4,207

Forest type group/ local type	Average annual net growth of sawtimber				Average annual removals of sawtimber			
		Major species group				Major species group		
	All species	Softwoods	Soft hardwoods	Hard hardwoods	All species	Softwoods	Soft hardwoods	Hard hardwoods
	(In thousand board feet) [1]				*(In thousand board feet)* [1]			
Eastern redcedar								
Eastern redcedar	315	314	--	1	--	--	--	--
Eastern redcedar-hardwood	1,252	361	541	350	188	--	154	34
Total	1,567	675	541	351	188	--	154	34
Oak-hickory								
Red oak-white oak-hickory	17,355	99	2,297	14,959	4,919	--	398	4,521
Bur oak	364	-2	-7	373	267	--	29	238
Post-blackjack oak	4,005	71	150	3,784	354	--	124	230
Total	21,724	168	2,440	19,116	5,540	--	551	4,989
Elm-ash-cottonwood								
Cottonwood	9,135	--	9,131	4	5,086	--	4,905	181
Elm-ash-cottonwood	11,563	39	8,030	3,494	3,808	--	2,565	1,243
Willow	-12	14	-13	-13	--	--	--	--
Total	20,686	53	17,148	3,485	8,894	--	7,470	1,424
Maple-beech-birch								
Lowland plains hardwoods	24,065	163	14,425	9,477	7,870	--	3,718	4,152
Total	24,065	163	14,425	9,477	7,870	--	3,718	4,152
Elm-ash-locust								
Elm-ash-locust	23,484	188	10,202	13,094	7,551	75	2,679	4,797
Total	23,484	188	10,202	13,094	7,551	75	2,679	4,797
Nonstocked	-25	--	22	-47	--	--	--	--
All forest types	91,501	1,247	44,778	45,476	30,043	75	14,572	15,396

[1] International 1/4-inch rule.

Table 26. -- All live aboveground tree biomass on timberland by ownership class, major species group, and tree biomass component, Kansas, 1994

(In green tons)

Ownership class and major species group	All components	Tree biomass component						
		All live 1-5 inch trees	Growing-stock trees			Non-growing-stock trees		
			Stumps	Boles	Tops and limbs	Stumps	Boles	Tops and limbs
Federal								
Softwoods	20,791	6,359	1,227	9,058	3,016	103	782	246
Soft hardwoods	1,271,295	81,825	48,927	511,641	149,711	32,062	344,529	102,600
Hard hardwoods	1,369,237	64,375	46,180	534,268	159,637	33,574	415,519	115,684
Total	2,661,323	152,559	96,334	1,054,967	312,364	65,739	760,830	218,530
State								
Softwoods	10,225	5,505	--	--	--	350	3,421	949
Soft hardwoods	1,117,417	61,254	44,411	544,691	149,721	20,669	230,801	65,870
Hard hardwoods	843,882	64,019	29,838	397,889	110,864	14,501	177,006	49,765
Total	1,971,524	130,778	74,249	942,580	260,585	35,520	411,228	116,584
County and municipal								
Softwoods	6,245	1,664	396	3,192	993	--	--	--
Soft hardwoods	139,514	4,752	5,391	58,596	17,257	3,152	39,853	10,513
Hard hardwoods	210,261	6,009	7,502	87,494	25,973	5,007	60,257	18,019
Total	356,020	12,425	13,289	149,282	44,223	8,159	100,110	28,532
Indian								
Softwoods	3,229	764	204	1,758	503	--	--	--
Soft hardwoods	34,285	5,138	1,572	21,084	4,864	157	1,077	393
Hard hardwoods	11,544	1,010	393	4,321	1,413	262	3,159	986
Total	49,058	6,912	2,169	27,163	6,780	419	4,236	1,379
Corporate								
Softwoods	25,937	18,325	700	5,156	1,756	--	--	--
Soft hardwoods	2,017,042	158,426	67,424	769,872	215,789	47,610	601,178	156,743
Hard hardwoods	2,682,227	170,333	106,999	1,161,568	366,673	57,042	631,050	188,562
Total	4,725,206	347,084	175,123	1,936,596	584,218	104,652	1,232,228	345,305
Individual								
Softwoods	972,166	246,967	47,797	379,918	120,247	14,213	127,252	35,772
Soft hardwoods	39,886,885	3,136,595	1,419,921	16,652,457	4,541,309	908,102	10,345,282	2,883,219
Hard hardwoods	44,096,068	2,701,738	1,612,159	18,712,416	5,543,510	966,827	11,286,196	3,273,222
Total	84,955,119	6,085,300	3,079,877	35,744,791	10,205,066	1,889,142	21,758,730	6,192,213
All ownerships								
Softwoods	1,038,593	279,584	50,324	399,082	126,515	14,666	131,455	36,967
Soft hardwoods	44,466,438	3,447,990	1,587,646	18,558,341	5,078,651	1,011,752	11,562,720	3,219,338
Hard hardwoods	49,213,219	3,007,484	1,803,071	20,897,956	6,208,070	1,077,213	12,573,187	3,646,238
Total	94,718,250	6,735,058	3,441,041	39,855,379	11,413,236	2,103,631	24,267,362	6,902,543

Table 27. -- Area of land by land class, local forest type, and Forest Survey Unit, Kansas, 1981 and 1994

(In thousand acres)

Land class and local forest type	All units		Forest Survey Unit					
			Northeastern		Southeastern		Western	
	1981	1994	1981	1994	1981	1994	1981	1994
Forest land								
Timberland								
Eastern redcedar	8.4	23.0	7.2	8.6	1.2	12.9	--	1.5
Eastern redcedar-hardwood	20.4	45.8	9.0	17.4	10.3	22.8	1.1	5.6
Red oak-white oak-hickory	272.1	270.1	166.4	135.1	105.7	120.7	--	14.3
Bur oak	21.5	15.6	9.9	12.0	1.3	0.3	10.3	3.3
Post-blackjack oak	48.4	89.8	2.4	2.8	46.0	87.0	--	--
Cottonwood	67.0	65.5	13.4	6.7	5.2	10.7	48.4	48.1
Elm-ash-cottonwood	148.5	166.4	46.1	50.1	50.3	90.9	52.1	25.4
Willow	3.4	3.3	3.4	3.2	--	--	--	0.1
Lowland plains hardwoods	210.4	326.0	116.0	137.4	79.3	144.8	15.1	43.8
Elm-ash-locust	408.4	478.8	218.6	204.9	135.1	169.8	54.7	104.1
Nonstocked	4.0	7.4	--	3.5	4.0	1.8	--	2.1
Total	1,212.5	1,491.7	592.4	581.7	438.4	661.7	181.7	248.3
Reserved forest land	22.4	17.4	15.1	8.6	2.3	--	5.0	8.8
Other forest land	128.5	37.0	21.1	4.0	96.9	25.3	10.5	7.7
All forest land	1,363.4	1,546.1	628.6	594.3	537.6	687.0	197.2	264.8
Nonforest land								
Nonforest with trees								
Cropland with trees	62.2	68.0	29.7	29.4	13.4	25.0	19.1	13.2
Pasture with trees	531.6	819.0	140.2	218.7	223.1	409.6	168.3	190.7
Wooded strips	148.5	265.0	61.8	119.0	49.8	84.2	36.9	61.8
Idle farmland with trees	23.8	26.2	4.0	9.9	2.6	13.0	17.2	3.3
Marsh with trees	22.4	15.2	4.1	1.8	4.2	7.9	14.1	5.5
Urban and other with trees	--	232.9	--	104.0	--	86.9	--	42.0
Windbreaks	184.9	218.7	42.5	60.5	66.5	70.7	75.9	87.5
Wooded pasture	209.6	252.2	60.8	82.9	94.8	134.3	54.0	35.0
Total	1,183.0	1,897.2	343.1		454.4	831.6	385.5	439.0
Nonforest without trees								
Cropland	32,011.2	31,352.1	5,171.9	3,866.2	3,914.2	3,006.0	22,925.1	24,479.9
Improved pasture	15,818.2	15,829.6	1,978.4	2,888.5	4,629.2	4,911.0	9,210.6	8,030.1
Idle farmland	7.6	559.4	3.0	96.1	4.6	133.8	--	329.5
Marsh	55.7	37.9	1.5	1.2	7.0	1.5	47.2	35.2
Other farm farmstead	200.0	308.5	68.9	88.1	36.0	54.6	95.1	165.8
Urban and other	1,422.7	744.3	384.3	257.2	343.9	137.7	694.5	349.4
Noncensus water	109.3	91.4	27.5	22.9	31.7	44.3	50.1	24.2
Census water	328.9	294.5	158.1	109.3	82.2	84.6	88.6	100.6
Total	49,953.6	49,217.7	7,793.6	7,329.5	9,048.8	8,373.5	33,111.2	33,514.7
All nonforest land	51,136.6	51,114.9	8,136.7	7,956.1	9,503.2	9,205.1	33,496.6	33,953.7
Total land	52,500.0	52,661.0	8,765.3	8,550.4	10,040.8	9,892.1	33,693.9	34,218.5

[1] The 1981 and 1994 totals for all units include 109.3 thousand acres and 91.4 thousand acres, respectively, of water according to FIA standards of area classification, but defined by the Bureau of the Census as land.

Table 28. -- Area of timberland by Forest Survey Unit and county/county group, Kansas, 1981 and 1994

(In thousand acres)

Forest Survey Unit and county/county group	1981	1994
Northeastern		
Atchison	21.2	24.8
Clay Center [1]	42.2	40.5
Doniphan	38.6	32.7
Douglas	28.6	27.5
Franklin	28.1	26.8
Jackson	40.6	28.8
Jefferson	48.1	41.9
Johnson-Wyandotte	36.1	34.4
Leavenworth	56.0	38.1
Marshall	36.2	28.8
Miami	48.6	45.0
Nemaha-Brown	23.4	31.3
Osage	25.7	34.7
Pottawatomie	34.6	41.8
Riley-Geary	40.5	47.2
Shawnee	19.0	25.6
Wabaunsee	24.9	31.8
Total	592.4	581.7
Southeastern		
Anderson	21.6	29.4
Bourbon	34.7	48.4
Butler	15.2	22.7
Chautauqua	27.0	44.7
Cherokee	41.5	45.9
Coffey	14.5	20.2
Cowley	19.1	23.3
Crawford	19.0	43.3
Elk	14.6	27.2
Emporia [2]	36.9	57.4
Greenwood	27.1	26.9
Labette	20.7	36.9
Linn	61.8	61.4
Montgomery	18.6	49.8
Neosho	16.9	30.7
Wilson	23.6	49.8
Woodson-Allen	25.6	43.7
Total	438.4	661.7
Western		
Colby-Garden City-Dodge City [3]	16.7	16.3
Great Bend-Hutchinson [4]	15.1	33.0
Hays [5]	40.1	62.9
Jewell-Mitchell	32.9	32.0
Republic-Cloud	25.3	30.0
Salina [6]	29.1	27.7
Wichita [7]	22.5	46.4
Total	181.7	248.3
All counties	1,212.5	1,491.7

[1] Includes: Clay, Dickinson, and Washington counties.

[2] Includes: Chase, Lyon, Marion, and Morris counties.

[3] Includes: Cheyenne, Clark, Comanche, Decatur, Finney, Ford, Gove, Grant, Gray, Greeley, Hamilton, Haskell, Hodgeman, Kearny, Kiowa, Lane, Logan, Meade, Morton, Ness, Rawlins, Scott, Seward, Sheridan, Sherman, Stanton, Stevens, Thomas, Wallace, and Wichita counties.

[4] Includes: Barton, Edwards, Harvey, McPherson, Pawnee, Reno, Rice, Rush, and Stafford counties.

[5] Includes: Ellis, Graham, Norton, Osborne, Phillips, Rooks, Russell, Smith, and Trego counties.

[6] Includes: Ellsworth, Lincoln, Ottawa, and Saline counties.

[7] Includes: Barber, Harper, Kingman, Pratt, Sedgwick, and Sumner counties.

Table 29. -- Area of timberland by Forest Survey Unit and stand-size class, Kansas, 1981 and 1994

(In thousand acres)

Forest Survey Unit and stand-size class	1981	1994
Northeastern		
Sawtimber	263.6	273.7
Poletimber	155.4	193.2
Sapling & seedling	173.4	111.3
Nonstocked	--	3.5
Total	592.4	581.7
Southeastern		
Sawtimber	207.7	273.8
Poletimber	112.9	235.4
Sapling & seedling	113.8	150.7
Nonstocked	4.0	1.8
Total	438.4	661.7
Western		
Sawtimber	139.6	164.6
Poletimber	29.8	43.3
Sapling & seedling	12.3	38.3
Nonstocked	--	2.1
Total	181.7	248.3
All units		
Sawtimber	610.9	712.1
Poletimber	298.1	471.9
Sapling & seedling	299.5	300.3
Nonstocked	4.0	7.4
Total	1,212.5	1,491.7

Table 30. -- Area of timberland by local forest type, stand-size class, and ownership class, Kansas, 1994

(In thousand acres)

Local forest type and stand-size class	All ownerships	Ownership class					
		Federal	State	County and municipal	Indian	Corporate	Individual
Eastern redcedar							
Sawtimber	4.0	--	--	--	--	--	4.0
Poletimber	5.0	0.1	--	--	--	--	4.9
Sapling & seedling	14.0	0.7	--	--	--	2.8	10.5
Total	23.0	0.8	--	--	--	2.8	19.4
Eastern redcedar-hardwood							
Sawtimber	10.2	--	--	--	--	0.9	9.3
Poletimber	16.1	--	1.2	--	--	--	14.9
Sapling & seedling	19.5	--	--	--	0.7	--	18.8
Total	45.8	--	1.2	--	0.7	0.9	43.0
Red oak-white oak-hickory							
Sawtimber	138.8	12.4	4.6	1.8	--	8.8	111.2
Poletimber	94.8	2.3	0.9	--	--	4.2	87.4
Sapling & seedling	36.5	1.3	0.5	--	--	2.4	32.3
Total	270.1	16.0	6.0	1.8	--	15.4	230.9
Bur oak							
Sawtimber	9.6	0.4	--	--	--	--	9.2
Poletimber	5.4	--	--	--	--	0.7	4.7
Sapling & seedling	0.6	--	--	--	--	--	0.6
Total	15.6	0.4	--	--	--	0.7	14.5
Post-blackjack oak							
Sawtimber	19.1	--	--	--	--	--	19.1
Poletimber	52.2	0.8	--	--	--	5.1	46.3
Sapling & seedling	18.5	--	--	--	--	0.9	17.6
Total	89.8	0.8	--	--	--	6.0	83.0
Cottonwood							
Sawtimber	56.5	0.3	4.2	--	--	2.1	49.9
Poletimber	9.0	0.1	4.5	--	--	0.4	4.0
Sapling & seedling	--	--	--	--	--	--	--
Total	65.5	0.4	8.7	--	--	2.5	53.9
Elm-ash-cottonwood							
Sawtimber	95.5	5.0	1.5	--	--	5.1	83.9
Poletimber	52.5	2.1	1.1	--	--	3.9	45.4
Sapling & seedling	18.4	1.4	--	--	--	2.6	14.4
Total	166.4	8.5	2.6	--	--	11.6	143.7
Willow							
Sawtimber	0.1	--	--	--	--	--	0.1
Poletimber	1.1	--	--	--	--	--	1.1
Sapling & seedling	2.1	1.2	--	--	--	--	0.9
Total	3.3	1.2	--	--	--	--	2.1
Lowland plains hardwoods							
Sawtimber	161.8	7.9	0.8	0.7	--	5.5	146.9
Poletimber	109.8	3.3	1.1	0.7	--	7.0	97.7
Sapling & seedling	54.4	1.2	0.9	--	--	1.2	51.1
Total	326.0	12.4	2.8	1.4	--	13.7	295.7
Elm-ash-locust							
Sawtimber	216.5	7.7	1.7	--	0.8	8.7	197.6
Poletimber	126.0	3.1	1.8	0.6	--	2.5	118.0
Sapling & seedling	136.3	0.5	6.8	1.6	1.0	9.2	117.2
Total	478.8	11.3	10.3	2.2	1.8	20.4	432.8
Nonstocked	7.4	0.9	--	2.1	--	1.3	3.1
All forest types							
Sawtimber	712.1	33.7	12.8	2.5	0.8	31.1	631.2
Poletimber	471.9	11.8	10.6	1.3	--	23.8	424.4
Sapling & seedling	300.3	6.3	8.2	1.6	1.7	19.1	263.4
Nonstocked	7.4	0.9	--	2.1	--	1.3	3.1
Total	1,491.7	52.7	31.6	7.5	2.5	75.3	1,322.1

Table 31. -- Area of timberland by local forest type, stand-size class, and potential productivity class, Kansas, 1994

(In thousand acres)

Local forest type and stand size class	All classes	Potential productivity class (cubic feet of growth per acre per year)				
		165+	120-164	85-119	50-84	20-49
Eastern redcedar						
Sawtimber	4.0	--	--	0.8	1.3	1.9
Poletimber	5.0	--	--	0.9	0.8	3.3
Sapling & seedling	14.0	--	--	--	1.3	12.7
Total	23.0	--	--	1.7	3.4	17.9
Eastern redcedar-hardwood						
Sawtimber	10.2	--	0.2	--	1.4	8.6
Poletimber	16.1	--	1.2	2.8	5.1	7.0
Sapling & seedling	19.5	--	1.3	12.1	1.5	4.6
Total	45.8	--	2.7	14.9	8.0	20.2
Red oak-white oak-hickory						
Sawtimber	138.8	3.9	1.4	23.2	71.9	38.4
Poletimber	94.8	1.7	1.6	12.6	44.9	34.0
Sapling & seedling	36.5	--	--	3.7	23.5	9.3
Total	270.1	5.6	3.0	39.5	140.3	81.7
Bur oak						
Sawtimber	9.6	--	--	--	5.7	3.9
Poletimber	5.4	--	--	--	1.7	3.7
Sapling & seedling	0.6	--	--	0.5	0.1	--
Total	15.6	--	--	0.5	7.5	7.6
Post-blackjack oak						
Sawtimber	19.1	--	--	0.8	3.2	15.1
Poletimber	52.2	--	--	0.4	19.3	32.5
Sapling & seedling	18.5	--	--	0.9	7.6	10.0
Total	89.8	--	--	2.1	30.1	57.6
Cottonwood						
Sawtimber	56.5	--	2.4	6.4	27.1	20.6
Poletimber	9.0	--	0.7	0.8	5.6	1.9
Sapling & seedling	--	--	--	--	--	--
Total	65.5	--	3.1	7.2	32.7	22.5
Elm-ash-cottonwood						
Sawtimber	95.5	--	10.2	27.2	41.5	16.6
Poletimber	52.5	--	7.4	9.9	19.2	16.0
Sapling & seedling	18.4	--	--	3.9	8.3	6.2
Total	166.4	--	17.6	41.0	69.0	38.8
Willow						
Sawtimber	0.1	--	--	--	--	0.1
Poletimber	1.1	--	--	0.8	0.3	--
Sapling & seedling	2.1	--	--	--	0.3	1.8
Total	3.3	--	--	0.8	0.6	1.9
Lowland plains hardwoods						
Sawtimber	161.8	--	0.2	35.5	60.1	66.0
Poletimber	109.8	--	4.3	16.8	36.9	51.8
Sapling & seedling	54.4	--	3.4	7.7	12.1	31.2
Total	326.0	--	7.9	60.0	109.1	149.0
Elm-ash-locust						
Sawtimber	216.5	--	8.9	54.7	68.4	84.5
Poletimber	126.0	--	6.6	18.5	35.9	65.0
Sapling & seedling	136.3	--	6.9	15.2	50.0	64.2
Total	478.8	--	22.4	88.4	154.3	213.7
Nonstocked	7.4	--	--	0.1	3.6	3.7
All forest types						
Sawtimber	712.1	3.9	23.3	148.6	280.6	255.7
Poletimber	471.9	1.7	21.8	63.5	169.7	215.2
Sapling & seedling	300.3	--	11.6	44.0	104.7	140.0
Nonstocked	7.4	--	--	0.1	3.6	3.7
Total	1,491.7	5.6	56.7	256.2	558.6	614.6

Table 32. -- Area of timberland by local forest type, stand-size class, and basal-area class, Kansas, 1994

(In thousand acres)

Local forest type and stand-size class	All classes	Basal-area class (square feet per acre)													
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-150	151-180	181+
Eastern redcedar															
Sawtimber	4.0	--	--	--	--	1.9	--	--	1.3	--	--	--	0.8	--	--
Poletimber	5.0	0.3	0.1	--	0.4	--	--	1.8	0.8	1.6	--	--	--	--	--
Sapling & seedling	14.0	3.1	4.5	2.2	4.2	--	--	--	--	--	--	--	--	--	--
Total	23.0	3.4	4.6	2.2	4.6	1.9	--	1.8	2.1	1.6	--	--	0.8	--	--
Eastern redcedar-hardwood															
Sawtimber	10.2	0.1	--	--	1.6	0.9	0.5	0.8	--	3.5	2.3	0.5	--	--	--
Poletimber	16.1	0.1	--	--	0.3	--	1.9	2.4	2.8	4.9	0.5	2.3	--	0.9	--
Sapling & seedling	19.5	1.3	8.4	3.5	4.5	1.0	--	--	0.8	--	--	--	--	--	--
Total	45.8	1.5	8.4	3.5	6.4	1.9	2.4	3.2	3.6	8.4	2.8	2.8	--	0.9	--
Red oak-white oak-hickory															
Sawtimber	138.8	0.7	12.3	4.2	2.1	7.8	6.3	21.9	17.1	8.4	20.1	22.9	12.6	1.6	0.8
Poletimber	94.8	1.4	0.9	2.8	4.9	3.8	14.4	3.9	13.5	20.1	10.9	8.0	7.7	2.5	--
Sapling & seedling	36.5	6.6	3.0	8.0	6.6	3.0	4.3	2.8	--	1.5	0.7	--	--	--	--
Total	270.1	8.7	16.2	15.0	13.6	14.6	25.0	28.6	30.6	30.0	31.7	30.9	20.3	4.1	0.8
Bur oak															
Sawtimber	9.6	0.2	--	1.0	--	1.7	--	0.7	--	0.7	2.0	--	3.3	--	--
Poletimber	5.4	--	--	--	0.3	--	2.4	0.7	0.9	0.7	--	0.4	--	--	--
Sapling & seedling	0.6	0.1	--	--	--	--	--	--	--	--	--	0.5	--	--	--
Total	15.6	0.3	--	1.0	0.3	1.7	2.4	1.4	0.9	1.4	2.0	0.9	3.3	--	--
Post-blackjack oak															
Sawtimber	19.1	--	--	2.9	0.2	1.4	--	4.3	2.4	1.7	2.2	4.0	--	--	--
Poletimber	52.2	1.0	0.2	0.2	3.0	3.0	0.9	4.9	8.9	8.8	4.6	12.0	4.7	--	--
Sapling & seedling	18.5	0.9	3.9	2.9	2.3	3.3	3.7	0.7	0.8	--	--	--	--	--	--
Total	89.8	1.9	4.1	6.0	5.5	7.7	4.6	9.9	12.1	10.5	6.8	16.0	4.7	--	--
Cottonwood															
Sawtimber	56.5	0.2	--	--	1.1	5.4	5.0	8.4	10.8	0.5	1.7	3.3	9.5	4.4	6.2
Poletimber	9.0	0.6	3.1	--	--	3.8	0.7	--	--	0.8	--	--	--	--	--
Sapling & seedling	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	65.5	0.8	3.1	--	1.1	9.2	5.7	8.4	10.8	1.3	1.7	3.3	9.5	4.4	6.2
Elm-ash-cottonwood															
Sawtimber	95.5	--	4.3	4.4	4.3	5.4	3.7	5.9	6.6	4.3	14.0	17.1	6.2	12.0	7.3
Poletimber	52.5	0.7	4.7	3.4	6.0	2.2	5.0	1.6	1.7	4.7	2.3	10.5	9.3	0.4	--
Sapling & seedling	18.4	1.8	3.9	2.3	1.1	1.6	3.0	3.9	--	--	--	--	0.8	--	--
Total	166.4	2.5	12.9	10.1	11.4	9.2	11.7	11.4	8.3	9.0	16.3	27.6	16.3	12.4	7.3
Willow															
Sawtimber	0.1	--	0.1	--	--	--	--	--	--	--	--	--	--	--	--
Poletimber	1.1	--	--	--	--	--	--	--	0.8	--	--	--	0.3	--	--
Sapling & seedling	2.1	2.1	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	3.3	2.1	0.1	--	--	--	--	--	0.8	--	--	--	0.3	--	--

(Table 32 continued on next page)

(Table 32 continued)

Local forest type and stand-size class	All classes	Basal-area class (square feet per acre)													
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-150	151-180	181+
Lowland plains hardwoods															
Sawtimber	161.8	0.3	2.4	2.4	5.7	6.8	16.5	15.9	24.6	13.9	12.3	22.2	17.0	11.6	10.2
Poletimber	109.8	1.8	1.3	2.0	7.3	13.1	5.5	10.9	11.9	15.4	10.9	24.5	3.2	0.5	1.5
Sapling & seedling	54.4	5.8	19.9	11.9	0.6	5.1	2.6	6.6	1.0	--	--	--	--	0.9	--
Total	326.0	7.9	23.6	16.3	13.6	25.0	24.6	33.4	37.5	29.3	23.2	46.7	20.2	13.0	11.7
Elm-ash-locust															
Sawtimber	216.5	0.9	10.1	10.3	9.7	18.7	12.6	18.4	19.5	22.9	16.5	34.7	28.5	9.4	4.3
Poletimber	126.0	3.7	2.2	5.8	6.2	8.5	17.0	11.7	21.2	18.1	8.5	10.4	8.2	3.9	0.6
Sapling & seedling	136.3	18.2	18.0	14.3	25.5	26.9	11.1	8.9	6.3	2.7	1.5	2.9	--	--	--
Total	478.8	22.8	30.3	30.4	41.4	54.1	40.7	39.0	47.0	43.7	26.5	48.0	36.7	13.3	4.9
Nonstocked	7.4	6.8	--	--	--	--	0.6	--	--	--	--	--	--	--	--
All forest types															
Sawtimber	712.1	2.4	29.2	25.2	24.7	50.0	44.6	76.3	82.3	55.9	71.1	104.7	77.9	39.0	28.8
Poletimber	471.9	9.6	12.5	14.2	28.4	34.4	47.8	37.9	62.5	75.1	37.7	68.1	33.4	8.2	2.1
Sapling & seedling	300.3	39.9	61.6	45.1	44.8	40.9	24.7	22.9	8.9	4.2	2.2	3.4	0.8	0.9	--
Nonstocked	7.4	6.8	--	--	--	--	0.6	--	--	--	--	--	--	--	--
Total	1,491.7	58.7	103.3	84.5	97.9	125.3	117.7	137.1	153.7	135.2	111.0	176.2	112.1	48.1	30.9

Table 33. -- Net volume of growing stock on timberland by species group and Forest Survey Unit, Kansas, 1981 and 1994

(In thousand cubic feet)

Species group	All units		Forest Survey Unit					
			Northeastern		Southeastern		Western	
	1981	1994	1981	1994	1981	1994	1981	1994
Softwoods								
Eastern redcedar	5,057	16,587	2,580	8,414	2,419	7,743	58	430
Total softwoods	5,057	16,587	2,580	8,414	2,419	7,743	58	430
Hardwoods								
Select white oak	122,702	134,610	65,652	71,373	33,788	47,884	23,262	15,353
Other white oak	25,297	46,996	3,803	4,094	21,494	42,902	--	--
Select red oak	56,069	75,025	31,001	36,237	25,068	38,788	--	--
Other red oak	36,170	47,419	20,592	16,545	15,578	30,874	--	--
Select hickory	30,578	40,009	13,905	17,283	16,673	22,726	--	--
Other hickory	13,904	19,865	8,056	12,030	5,848	7,835	--	--
Basswood	7,739	8,659	7,250	8,148	489	511	--	--
Hard maple	3,929	3,113	2,097	1,828	1,832	1,285	--	--
Soft maple	24,175	37,615	11,936	15,060	12,239	19,704	--	2,851
Elm	37,073	74,779	16,675	33,204	14,451	28,950	5,947	12,625
White & green ash	75,516	110,257	16,658	25,553	31,684	54,349	27,174	30,355
Sycamore	30,145	44,240	15,575	24,502	14,150	19,224	420	514
Cottonwood	166,084	211,488	49,598	42,796	12,091	33,336	104,395	135,356
Willow	14,997	18,028	6,194	5,481	5,425	7,806	3,378	4,741
Hackberry	101,050	181,464	43,660	73,511	43,339	83,590	14,051	24,363
Black cherry	1,570	4,172	1,061	1,348	509	2,824	--	--
Black walnut	69,288	94,419	38,840	46,680	27,250	42,731	3,198	5,008
Other hardwoods	55,389	86,579	27,385	39,379	14,499	28,314	13,505	18,886
Total hardwoods	871,675	1,238,737	379,938	475,052	296,407	513,633	195,330	250,052
All species	876,732	1,255,324	382,518	483,466	298,826	521,376	195,388	250,482

Table 34. -- Net volume of sawtimber on timberland by species group and Forest Survey Unit, Kansas, 1981 and 1994

(In thousand board feet)[1]

Species group	All units		Forest Survey Unit					
			Northeastern		Southeastern		Western	
	1981	1994	1981	1994	1981	1994	1981	1994
Softwoods								
Eastern redcedar	10,861	30,777	4,819	16,497	6,042	13,166	--	1,114
Total softwoods	10,861	30,777	4,819	16,497	6,042	13,166	--	1,114
Hardwoods								
Select white oak	506,804	554,661	260,692	284,534	129,205	192,567	116,907	77,560
Other white oak	46,628	100,820	9,527	12,348	37,101	88,472	--	--
Select red oak	220,601	302,736	125,324	152,447	95,277	150,289	--	--
Other red oak	139,251	165,792	83,493	67,376	55,758	98,416	--	--
Select hickory	81,443	104,302	27,809	34,909	53,634	69,393	--	--
Other hickory	24,702	46,748	13,008	25,819	11,694	20,929	--	--
Basswood	33,131	33,281	32,245	32,395	886	886	--	--
Hard maple	7,584	6,155	3,753	3,106	3,831	3,049	--	--
Soft maple	96,862	158,689	50,141	61,679	46,721	82,633	--	14,377
Elm	87,994	145,844	33,530	52,041	34,076	61,942	20,388	31,861
White & green ash	218,094	332,754	50,777	76,278	94,540	167,461	72,777	89,015
Sycamore	141,776	215,123	72,823	118,314	66,897	94,272	2,056	2,537
Cottonwood	737,390	1,025,850	228,693	214,282	50,127	159,788	458,570	651,780
Willow	52,558	64,914	20,737	18,434	18,919	30,260	12,902	16,220
Hackberry	338,873	591,424	130,941	223,718	153,285	286,173	54,647	81,533
Black cherry	5,184	6,995	4,263	4,131	921	2,864	--	--
Black walnut	188,948	272,853	108,715	130,364	70,738	129,116	9,495	13,373
Other hardwoods	142,169	237,583	68,729	117,904	39,116	74,924	34,324	44,755
Total hardwoods	3,069,992	4,366,524	1,325,200	1,630,079	962,726	1,713,434	782,066	1,023,011
All species	3,080,853	4,397,301	1,330,019	1,646,576	968,768	1,726,600	782,066	1,024,125

[1] International 1/4-inch rule.

Table 35. -- Net volume of all live trees [1] greater than 5 inches in diameter at breast height on timberland by species group and diameter class, Kansas, 1994

(In thousand cubic feet)

Species group	All classes	Diameter class (inches at breast height)									
		5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods											
Eastern redcedar	21,873	7,097	5,568	3,729	2,258	1,527	971	144	184	395	--
Total softwoods	21,873	7,097	5,568	3,729	2,258	1,527	971	144	184	395	--
Hardwoods											
Select white oak	211,631	8,308	13,912	17,315	18,597	22,117	16,530	18,343	18,651	53,323	24,535
Other white oak	60,769	9,304	12,701	10,969	7,819	7,483	4,541	2,962	1,655	3,335	--
Select red oak	95,133	3,919	4,244	9,176	10,185	10,798	8,952	9,344	7,911	21,991	8,613
Other red oak	65,334	5,075	6,001	7,721	6,486	7,945	6,109	5,865	4,487	12,420	3,225
Select hickory	49,064	5,895	8,478	7,380	5,161	5,688	4,481	2,762	4,383	4,003	833
Other hickory	23,989	2,955	4,480	4,805	4,730	2,403	1,829	1,129	549	878	231
Basswood	12,177	958	852	1,657	1,021	1,375	1,665	1,619	892	2,138	--
Hard maple	3,953	624	1,042	679	913	571	56	68	--	--	--
Soft maple	65,549	846	1,460	2,923	4,846	3,267	4,907	7,710	5,874	18,753	14,963
Elm	147,618	25,958	25,192	26,193	17,677	13,540	9,909	8,542	4,363	13,115	3,129
White & green ash	156,836	13,498	16,514	21,633	18,512	14,500	17,491	12,190	12,068	20,911	9,519
Sycamore	56,693	505	1,567	1,382	1,822	3,377	3,229	3,367	4,032	15,385	22,027
Cottonwood	266,962	948	2,742	4,618	10,790	19,941	16,600	19,798	22,883	78,794	89,848
Willow	28,826	1,297	1,497	2,781	4,459	4,853	3,199	2,800	1,696	6,135	109
Hackberry	254,177	18,426	26,292	32,349	33,239	30,227	25,935	23,155	15,823	38,912	9,819
Black cherry	7,902	1,160	1,338	1,686	672	834	747	293	251	921	--
Black walnut	133,248	9,141	18,504	19,609	23,658	20,054	17,010	9,630	6,114	7,765	1,763
Other hardwoods	210,877	18,080	23,402	27,050	31,228	27,229	19,810	17,080	13,766	23,838	9,394
Total hardwoods	1,850,738	126,897	170,218	199,926	201,815	196,202	163,000	146,657	125,398	322,617	198,008
Noncommercial spp.	86,856	13,224	14,010	12,480	11,823	8,391	5,346	5,688	4,219	8,111	3,564
All species	1,959,467	147,218	189,796	216,135	215,896	206,120	169,317	152,489	129,801	331,123	201,572

[1] Net volume of all live trees 5 inches d.b.h. and larger from a 1-foot stump to a 4-inch top diameter outside bark.

Table 36. -- Net volume of tree species on timberland by major tree class and individual species, Kansas, 1994

Individual species	All live	Major tree class: All live trees: Growing stock	All live trees: Short-log	All live trees: Rough	All live trees: Rotten	Saw-log size trees: Total saw-log size trees	Saw-log size trees: Sawtimber	Saw-log size trees: Short-log
		(In thousand cubic feet)				*(In thousand board feet)* [1]		
Softwoods								
Eastern redcedar	21,873	16,587	332	4,809	145	32,067	30,777	1,290
Total softwoods	21,873	16,587	332	4,809	145	32,067	30,777	1,290
Hardwoods								
White oak	6,264	4,997	265	654	348	22,429	21,263	1,166
Bur oak	123,476	85,189	15,193	20,027	3,067	443,973	377,583	66,390
Chinkapin oak	81,891	44,424	8,942	26,577	1,948	192,628	155,815	36,813
Post oak	60,769	46,996	3,715	8,921	1,137	114,465	100,820	13,645
Northern red oak	93,058	73,966	5,457	8,654	4,981	320,896	299,641	21,255
Shumard oak	2,075	1,059	176	840	--	3,727	3,095	632
Shingle oak	298	298	--	--	--	1,000	1,000	--
Blackjack oak	18,307	8,949	1,647	6,919	792	22,074	16,968	5,106
Pin oak	20,003	17,796	729	386	1,092	72,208	69,745	2,463
Black oak	26,726	20,376	1,840	2,762	1,748	85,138	78,079	7,059
Pecan	14,907	10,648	1,713	2,261	285	38,263	31,775	6,488
Shellbark hickory	4,193	3,989	--	114	90	16,883	16,883	--
Shagbark hickory	27,279	23,404	480	2,486	909	50,178	49,078	1,100
Mockernut hickory	2,685	1,968	421	223	73	8,264	6,566	1,698
Bitternut hickory	23,600	19,585	1,000	2,633	382	49,244	45,569	3,675
Black hickory	389	280	60	--	49	1,401	1,179	222
American basswood	12,177	8,659	1,017	1,830	671	36,876	33,281	3,595
Sugar maple	3,953	3,113	45	626	169	6,300	6,155	145
Silver maple	65,549	37,615	9,894	13,798	4,242	200,413	158,689	41,724
Winged elm	105	105	--	--	--	499	499	--
American elm	120,300	59,290	12,544	46,861	1,605	167,905	113,515	54,390
Siberian elm	5,260	3,380	336	1,544	--	10,542	9,081	1,461
Slippery elm	20,434	11,438	1,832	6,675	489	28,631	21,525	7,106
Rock elm	1,519	566	200	753	--	2,131	1,224	907
Black ash	173	173	--	--	--	873	873	--
White ash	2,732	1,732	286	714	--	7,013	5,750	1,263
Green ash	154,104	108,525	13,555	25,955	6,069	383,209	327,004	56,205
Sycamore	56,693	44,240	6,020	2,766	3,667	236,609	215,123	21,486
Eastern cottonwood	266,962	211,488	19,306	22,975	13,193	1,095,041	1,025,850	69,191
Black willow	28,826	18,028	2,851	6,530	1,417	74,441	64,914	9,527
Hackberry	254,177	181,464	27,950	40,474	4,289	700,105	591,424	108,681
River birch	1,514	734	--	641	139	2,928	2,928	--
Black cherry	7,902	4,172	862	2,525	343	9,653	6,995	2,658
Black walnut	133,248	94,419	11,134	23,927	3,768	310,742	272,853	37,889
Boxelder	38,092	12,423	3,212	15,774	6,683	39,976	28,476	11,500
Western buckeye	630	--	--	613	17	--	--	--
Northern catalpa	15,168	7,128	486	4,432	3,122	26,043	24,799	1,244
Sugarberry	723	380	--	255	88	1,108	1,108	--
Persimmon	1,920	1,295	--	602	23	212	212	--
Kentucky coffeetree	13,070	9,533	728	2,173	636	31,912	29,553	2,359
Honeylocust	71,916	35,919	8,073	26,060	1,864	141,871	111,875	29,996
White mulberry	626	10	--	322	294	--	--	--
Red mulberry	55,602	13,401	4,445	32,249	5,507	44,288	29,300	14,988
Black locust	11,363	5,503	2,075	3,329	456	14,943	8,459	6,484
Sassafras	80	80	--	--	--	--	--	--
Total hardwoods	1,850,738	1,238,737	168,489	367,860	75,652	5,017,035	4,366,524	650,511
Noncommercial species	86,856	--	--	84,092	2,764	--	--	--
All species	1,959,467	1,255,324	168,821	456,761	78,561	5,049,102	4,397,301	651,801

[1] International 1/4-inch rule.

Table 37. -- Net volume of noncommercial tree species on timberland by individual species, Kansas, 1994

(In thousand cubic feet)

Noncommercial tree species	Non-growing-stock volume
Hawthorn	452
Osage-orange	81,023
Apple	63
Eastern hophornbeam	455
Wild plum	3
Eastern redbud	4,076
Ailanthus	305
Soapberry	479
All noncommercial species	86,856

Table 38. -- Net volume of growing stock on timberland by species group and local forest type, Kansas, 1994

(In thousand cubic feet)

Species group	All types	Local forest type										
		Eastern redcedar	Eastern redcedar-hardwood	Red oak-white oak-hickory	Bur oak	Post-blackjack oak	Cotton-wood	Elm-ash-cotton-wood	Willow	Lowland plains hardwoods	Elm-ash-locust	Non-stocked
Softwoods												
Eastern redcedar	16,587	4,832	5,660	1,303	114	550	--	206	60	1,653	2,209	--
Total softwoods	16,587	4,832	5,660	1,303	114	550	--	206	60	1,653	2,209	--
Hardwoods												
Select white oak	134,610	393	2,238	61,333	11,470	2,914	--	7,342	50	27,812	21,058	--
Other white oak	46,996	--	244	5,408	386	38,637	--	33	--	1,796	492	--
Select red oak	75,025	74	149	53,308	--	2,869	--	1,206	--	7,958	9,461	--
Other red oak	47,419	106	171	26,564	--	9,496	250	1,154	--	4,185	5,493	--
Select hickory	40,009	--	233	21,552	88	1,147	--	4,337	--	4,801	7,851	--
Other hickory	19,865	--	105	10,061	605	61	--	1,018	--	5,673	2,342	--
Basswood	8,659	--	71	2,794	--	--	--	207	--	4,778	809	--
Hard maple	3,113	--	--	1,337	--	--	--	--	--	1,776	--	--
Soft maple	37,615	--	--	231	--	--	535	19,710	--	1,346	15,793	--
Elm	74,779	34	701	5,347	311	726	576	11,756	--	14,135	41,145	48
White & green ash	110,257	42	--	7,026	514	337	622	27,713	--	13,107	60,896	--
Sycamore	44,240	--	286	2,987	--	--	--	16,122	--	7,156	17,689	--
Cottonwood	211,488	--	1,539	4,712	124	--	113,051	25,653	68	20,250	45,952	139
Willow	18,028	--	--	320	--	251	810	5,572	908	1,323	8,844	--
Hackberry	181,464	57	915	6,541	542	700	377	27,396	--	106,534	38,402	--
Black cherry	4,172	--	--	87	--	249	89	995	--	1,109	1,643	--
Black walnut	94,419	228	1,375	13,132	344	360	301	9,538	--	52,100	17,041	--
Other hardwoods	86,579	--	802	5,619	217	305	2,718	14,709	--	13,251	48,958	--
Total hardwoods	1,238,737	934	8,829	228,359	14,601	58,052	119,329	174,461	1,026	289,090	343,869	187
All species	1,255,324	5,766	14,489	229,662	14,715	58,602	119,329	174,667	1,086	290,743	346,078	187

Table 39. -- Net volume of sawtimber on timberland by species group and local forest type, Kansas, 1994

(In thousand board feet)[1]

Species group	All types	Local forest type										
		Eastern redcedar	Eastern redcedar-hardwood	Red oak-white oak-hickory	Bur oak	Post-blackjack oak	Cotton-wood	Elm-ash-cotton-wood	Willow	Lowland plains hardwoods	Elm-ash-locust	Non-stocked
Softwoods												
Eastern redcedar	30,777	10,256	8,994	2,219	347	1,735	--	804	176	2,311	3,935	--
Total softwoods	30,777	10,256	8,994	2,219	347	1,735	--	804	176	2,311	3,935	--
Hardwoods												
Select white oak	554,661	581	8,797	235,358	46,553	6,413	--	33,772	256	128,269	94,662	--
Other white oak	100,820	--	675	10,791	1,343	78,094	--	--	--	8,165	1,752	--
Select red oak	302,736	--	543	215,242	--	9,855	--	4,779	--	33,313	39,004	--
Other red oak	165,792	--	385	103,240	--	17,916	--	4,415	--	15,958	23,878	--
Select hickory	104,302	--	378	46,108	--	3,516	--	17,041	--	11,490	25,769	--
Other hickory	46,748	--	--	20,743	1,173	--	--	2,451	--	16,438	5,943	--
Basswood	33,281	--	370	12,923	--	--	--	638	--	16,343	3,007	--
Hard maple	6,155	--	--	3,903	--	--	--	--	--	2,252	--	--
Soft maple	158,689	--	--	1,067	--	--	2,278	82,926	--	6,124	66,294	--
Elm	145,844	--	1,134	7,823	478	412	--	30,415	--	27,495	78,087	--
White & green ash	332,754	--	--	14,464	2,066	1,310	222	88,485	--	44,294	181,913	--
Sycamore	215,123	--	1,326	9,728	--	--	--	80,946	--	35,090	88,033	--
Cottonwood	1,025,850	--	6,586	23,275	629	--	537,299	129,627	--	98,976	228,755	703
Willow	64,914	--	--	405	--	955	705	19,913	2,438	5,212	35,286	--
Hackberry	591,424	--	1,941	20,092	2,021	2,392	672	89,993	--	355,205	119,108	--
Black cherry	6,995	--	--	--	--	617	--	518	--	3,478	2,382	--
Black walnut	272,853	251	2,605	39,173	1,188	960	546	32,277	--	148,235	47,618	--
Other hardwoods	237,583	--	750	16,675	559	--	2,820	36,689	--	35,146	144,944	--
Total hardwoods	4,366,524	832	25,490	781,010	56,010	122,440	544,542	654,885	2,694	991,483	1,186,435	703
All species	4,397,301	11,088	34,484	783,229	56,357	124,175	544,542	655,689	2,870	993,794	1,190,370	703

[1] International 1/4-inch rule.

Table 40. -- Net volume of short-log trees (cull volume) in cubic feet on timberland by species group and diameter class, Kansas, 1994

(In thousand cubic feet)

Species group	All classes	Diameter class (inches at breast height)							
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods									
Eastern redcedar	332	118	45	84	--	--	--	85	--
Total softwoods	332	118	45	84	--	--	--	85	--
Hardwoods									
Select white oak	23,661	--	3,132	2,967	2,383	2,065	3,175	6,939	3,000
Other white oak	3,197	--	901	671	472	297	101	755	--
Select red oak	5,563	--	808	537	622	478	714	649	1,755
Other red oak	3,857	--	705	1,282	642	427	801	--	--
Select hickory	2,434	--	381	337	263	251	--	1,202	--
Other hickory	1,010	--	237	371	81	90	--	--	231
Basswood	1,017	--	51	266	175	62	239	224	--
Hard maple	45	--	45	--	--	--	--	--	--
Soft maple	9,894	--	789	533	365	981	599	2,109	4,518
Elm	14,468	--	3,634	3,073	3,620	1,746	657	1,738	--
White & green ash	13,665	--	2,978	1,743	2,909	1,801	1,341	2,364	529
Sycamore	5,932	--	49	281	385	323	--	--	4,894
Cottonwood	19,306	--	741	1,368	879	1,203	1,387	11,194	2,534
Willow	2,851	--	848	353	421	509	248	472	--
Hackberry	26,917	--	4,963	5,026	5,409	3,695	1,525	5,435	864
Black cherry	817	--	95	341	319	--	--	62	--
Black walnut	10,965	--	2,930	2,835	1,793	1,646	1,108	254	399
Other hardwoods	17,579	--	4,874	2,625	1,852	1,851	1,949	4,428	--
Total hardwoods	163,178	--	28,161	24,609	22,590	17,425	13,844	37,825	18,724
All species	163,510	118	28,206	24,693	22,590	17,425	13,844	37,910	18,724

Table 41. -- Net volume of short-log trees (cull volume) in board feet[1] on timberland by species group and diameter class, Kansas, 1994

(In thousand board feet) [1]

Species group	All classes	Diameter class (inches at breast height)							
		9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0+
Softwoods									
Eastern redcedar	1,290	500	183	326	--	--	--	281	--
Total softwoods	1,290	500	183	326	--	--	--	281	--
Hardwoods									
Select white oak	104,369	--	13,117	12,570	10,217	8,980	13,978	31,294	14,213
Other white oak	13,645	--	3,734	2,808	2,004	1,284	428	3,387	--
Select red oak	21,887	--	2,932	2,007	2,396	1,886	2,835	2,638	7,193
Other red oak	14,628	--	2,547	4,782	2,454	1,678	3,167	--	--
Select hickory	9,286	--	1,340	1,213	962	953	--	4,818	--
Other hickory	3,897	--	850	1,372	309	350	--	--	1,016
Basswood	3,595	--	174	915	614	219	854	819	--
Hard maple	145	--	145	--	--	--	--	--	--
Soft maple	41,724	--	2,821	1,965	1,390	3,837	2,399	8,920	20,392
Elm	63,864	--	15,596	13,298	16,097	7,903	2,942	8,028	--
White & green ash	57,468	--	11,387	6,957	11,998	7,710	5,931	10,988	2,497
Sycamore	21,486	--	144	847	1,235	1,030	--	--	18,230
Cottonwood	69,191	--	2,297	4,487	2,925	4,256	4,914	41,504	8,808
Willow	9,527	--	2,727	1,178	1,357	1,789	839	1,637	--
Hackberry	108,681	--	19,421	19,829	21,798	14,816	6,292	22,715	3,810
Black cherry	2,658	--	297	1,091	1,053	--	--	217	--
Black walnut	37,889	--	9,655	9,653	6,216	5,872	4,061	948	1,484
Other hardwoods	66,571	--	17,392	9,666	6,985	7,076	7,664	17,788	--
Total hardwoods	650,511	--	106,576	94,638	90,010	69,639	56,304	155,701	77,643
All species	651,801	500	106,759	94,964	90,010	69,639	56,304	155,982	77,643

[1] International 1/4-inch rule.

Table 42. -- Current annual net growth of growing stock and sawtimber on timberland, 1981 and 1993, and average annual net growth of growing stock and sawtimber, 1981-1993, by softwoods and hardwoods, and Forest Survey Unit, Kansas

Forest Survey Unit and softwoods and hardwoods	Growing stock			Sawtimber		
	Current annual net growth	Average annual net growth	Current annual net growth	Current annual net growth	Average annual net growth	Current annual net growth
	1981	1981-1993	1993	1981	1981-1993	1993
	(In thousand cubic feet)			*(In thousand board feet)* [1]		
Northeastern						
Softwoods	257	446	394	425	600	507
Hardwoods	10,823	10,865	11,039	46,107	38,302	47,744
Total	11,080	11,311	11,433	46,532	38,902	48,251
Southeastern						
Softwoods	162	550	539	373	614	1,073
Hardwoods	8,715	11,835	12,685	33,557	40,326	48,448
Total	8,877	12,385	13,224	33,930	40,940	49,521
Western						
Softwoods	4	48	49	45	33	12
Hardwoods	1,889	2,031	2,863	8,062	10,626	18,190
Total	1,893	2,079	2,912	8,107	10,659	18,202
All Units						
Softwoods	423	1,044	982	843	1,247	1,592
Hardwoods	21,427	24,731	26,587	87,726	90,254	114,382
Total	21,850	25,775	27,569	88,569	91,501	115,974

[1] International 1/4-inch rule.

Table 43. -- Average annual net growth of growing stock on timberland by species group and local forest type, Kansas, 1981-1993

(In thousand cubic feet)

Species group	All types	Local forest type										
		Eastern redcedar	Eastern redcedar-hardwood	Red oak-white oak-hickory	Bur oak	Post-blackjack oak	Cotton-wood	Elm-ash-cotton-wood	Willow	Lowland plains hardwoods	Elm-ash-locust	Non-stocked
Softwoods												
Eastern redcedar	1,044	410	303	52	--	20	--	9	5	99	146	--
Total softwoods	1,044	410	303	52	--	20	--	9	5	99	146	--
Hardwoods												
Select white oak	1,462	14	63	833	91	60	--	12	-2	220	180	-9
Other white oak	1,132	--	9	108	13	962	--	2	--	25	13	--
Select red oak	1,393	6	2	988	--	89	--	24	--	93	191	--
Other red oak	1,192	45	14	464	--	507	7	37	--	54	64	--
Select hickory	584	--	7	367	--	16	--	-33	--	100	127	--
Other hickory	484	--	3	262	14	-8	--	23	--	126	64	--
Basswood	144	--	5	34	--	--	--	3	--	93	9	--
Hard maple	34	--	--	-6	--	--	--	--	--	46	-6	--
Soft maple	942	--	--	11	--	--	8	621	--	19	283	--
Elm	1,442	14	13	227	-3	48	34	162	--	126	816	5
White & green ash	2,495	2	--	209	7	10	26	687	--	315	1,239	--
Sycamore	473	--	8	70	--	-6	--	160	--	13	228	--
Cottonwood	1,610	--	74	124	4	2	1,039	173	3	122	65	4
Willow	271	--	--	6	-4	14	-5	7	41	17	195	--
Hackberry	6,855	4	42	233	11	25	86	999	--	3,762	1,693	--
Black cherry	107	--	--	3	--	10	--	14	--	38	42	--
Black walnut	2,339	8	55	165	4	2	2	186	--	1,443	474	--
Other hardwoods	1,772	-2	40	193	10	10	23	162	--	286	1,050	--
Total hardwoods	24,731	91	335	4,291	147	1,741	1,220	3,239	42	6,898	6,727	0
All species	25,775	501	638	4,343	147	1,761	1,220	3,248	47	6,997	6,873	0

Table 44. -- Average annual net growth of sawtimber on timberland by species group and local forest type, Kansas, 1981-1993

(In thousand board feet)[1]

Species group	All types	Local forest type										
		Eastern redcedar	Eastern redcedar-hardwood	Red oak-white oak-hickory	Bur oak	Post-blackjack oak	Cotton-wood	Elm-ash-cotton-wood	Willow	Lowland plains hardwoods	Elm-ash-locust	Non-stocked
Softwoods												
Eastern redcedar	1,247	314	361	99	-2	71	--	39	14	163	188	--
Total softwoods	1,247	314	361	99	-2	71	--	39	14	163	188	--
Hardwoods												
Select white oak	7,586	--	202	4,693	271	384	--	-53	-13	1,253	896	-47
Other white oak	2,789	--	33	216	37	2,320	--	--	--	148	35	--
Select red oak	6,743	--	--	4,346	--	266	--	110	--	465	1,556	--
Other red oak	3,463	--	30	2,359	--	523	--	113	--	177	261	--
Select hickory	1,490	--	5	684	--	199	--	17	--	289	296	--
Other hickory	1,516	--	--	831	28	--	--	29	--	538	90	--
Basswood	571	--	28	211	--	--	--	19	--	280	33	--
Hard maple	105	--	--	60	--	--	--	--	--	73	-28	--
Soft maple	4,293	--	--	51	--	--	59	2,346	--	89	1,748	--
Elm	1,540	--	99	8	-6	37	408	-359	--	177	1,176	--
White & green ash	7,898	--	--	475	16	40	30	1,552	--	648	5,137	--
Sycamore	2,502	--	18	405	--	-24	--	810	--	108	1,185	--
Cottonwood	11,124	--	257	669	--	8	7,810	1,083	--	524	751	22
Willow	2,242	--	--	120	-19	57	836	262	-13	148	851	--
Hackberry	21,662	--	62	830	18	46	13	3,332	--	12,491	4,870	--
Black cherry	191	--	--	--	--	26	--	40	--	99	26	--
Black walnut	8,959	1	80	812	21	52	23	1,279	--	5,301	1,390	--
Other hardwoods	5,580	--	77	486	--	--	-44	944	--	1,094	3,023	--
Total hardwoods	90,254	1	891	17,256	366	3,934	9,135	11,524	-26	23,902	23,296	-25
All species	91,501	315	1,252	17,355	364	4,005	9,135	11,563	-12	24,065	23,484	-25

[1] International 1/4-inch rule.

Table 45. -- Current annual net growth of growing stock on timberland by species group and local forest type, Kansas, 1993

(In thousand cubic feet)

Species group	All types	Local forest type										
		Eastern redcedar	Eastern redcedar-hardwood	Red oak-white oak-hickory	Bur oak	Post-blackjack oak	Cotton-wood	Elm-ash-cotton-wood	Willow	Lowland plains hardwoods	Elm-ash-locust	Non-stocked
Softwoods												
Eastern redcedar	982	373	306	39	--	17	--	3	3	88	153	--
Total softwoods	982	373	306	39	--	17	--	3	3	88	153	--
Hardwoods												
Select white oak	1,859	11	48	1,099	145	70	--	98	1	175	212	--
Other white oak	1,203	--	7	107	13	1,053	--	2	--	9	12	--
Select red oak	1,475	4	5	1,116	--	53	--	30	--	104	163	--
Other red oak	1,336	46	11	526	--	578	9	24	--	45	97	--
Select hickory	609	--	5	430	--	31	--	--	--	59	84	--
Other hickory	466	--	3	256	10	2	--	17	--	119	59	--
Basswood	150	--	2	47	--	--	--	17	--	69	15	--
Hard maple	67	--	--	29	--	--	--	--	--	38	--	--
Soft maple	1,051	--	--	6	--	--	-17	699	--	14	349	--
Elm	986	10	19	253	12	48	10	123	--	-23	529	5
White & green ash	2,744	2	--	320	6	10	19	745	--	432	1,210	--
Sycamore	501	--	8	82	--	--	--	157	--	59	195	--
Cottonwood	2,383	--	56	85	4	--	1,834	239	3	24	134	4
Willow	367	--	--	12	--	10	33	118	44	18	132	--
Hackberry	7,545	14	65	286	16	26	79	1,234	--	4,057	1,768	--
Black cherry	82	--	--	1	--	9	--	7	--	23	42	--
Black walnut	2,323	6	56	285	6	8	-4	215	--	1,274	477	--
Other hardwoods	1,440	--	41	224	1	15	4	257	--	290	608	--
Total hardwoods	26,587	93	326	5,164	213	1,913	1,967	3,982	48	6,786	6,086	9
All species	27,569	466	632	5,203	213	1,930	1,967	3,985	51	6,874	6,239	9

Table 46. -- Current annual net growth of sawtimber on timberland by species group and local forest type, Kansas, 1993

(In thousand board feet)[1]

Species group	All types	Local forest type										
		Eastern redcedar	Eastern redcedar-hardwood	Red oak-white oak-hickory	Bur oak	Post-blackjack oak	Cotton-wood	Elm-ash-cotton-wood	Willow	Lowland plains hardwoods	Elm-ash-locust	Non-stocked
Softwoods												
Eastern redcedar	1,592	476	678	201	-2	37	--	7	6	151	38	--
Total softwoods	1,592	476	678	201	-2	37	--	7	6	151	38	--
Hardwoods												
Select white oak	10,553	18	332	6,469	490	456	--	496	5	1,090	1,197	--
Other white oak	3,362	--	12	521	37	2,672	--	--	--	87	33	--
Select red oak	8,108	--	10	5,522	21	281	--	123	--	656	1,495	--
Other red oak	4,755	--	16	2,767	--	1,151	--	75	--	276	470	--
Select hickory	1,878	--	5	1,215	--	198	--	133	--	133	194	--
Other hickory	1,851	--	--	1,158	109	--	--	120	--	391	73	--
Basswood	767	--	10	294	--	--	--	115	--	297	51	--
Hard maple	104	--	--	75	--	--	--	--	--	29	--	--
Soft maple	4,700	--	--	32	--	--	-72	2,428	--	174	2,138	--
Elm	-232	-6	185	29	-4	18	397	-628	--	50	-273	--
White & green ash	10,868	--	--	776	23	51	182	1,595	--	1,096	7,145	--
Sycamore	2,799	--	44	676	--	13	--	874	--	396	796	--
Cottonwood	13,915	--	416	574	21	--	10,548	1,244	--	179	912	21
Willow	2,956	--	--	147	--	45	903	980	120	64	697	--
Hackberry	30,383	6	56	961	47	60	4	4,280	--	18,124	6,845	--
Black cherry	220	--	--	13	--	26	--	22	--	79	80	--
Black walnut	10,462	12	120	1,244	93	42	-4	1,454	--	5,550	1,951	--
Other hardwoods	6,933	--	225	445	4	--	-41	1,106	--	1,390	3,804	--
Total hardwoods	114,382	30	1,431	22,918	841	5,013	11,917	14,417	125	30,061	27,608	21
All species	115,974	506	2,109	23,119	839	5,050	11,917	14,424	131	30,212	27,646	21

Table 47. -- Current annual net growth, current annual mortality, and current annual removals of growing stock and sawtimber on timberland by species group, Kansas,1993

	Growing stock			Sawtimber		
Species group	Current annual net growth [1] 1993	Current annual mortality 1993	Current annual removals [2] 1993	Current annual net growth [1] 1993	Current annual mortality 1993	Current annual removals [2] 1993
	(In thousand cubic feet)			*(In thousand board feet)* [3]		
Softwoods						
Ponderosa pine	--	--	*	--	--	1
Eastern redcedar	982	98	57	1,592	330	149
Total softwoods	982	98	57	1,592	330	150
Hardwoods						
Select white oak	1,859	1,058	674	10,553	5,852	2,303
Other white oak	1,203	348	108	3,362	986	188
Select red oak	1,475	910	257	8,108	4,499	868
Other red oak	1,336	893	270	4,755	3,183	860
Select hickory	609	603	130	1,878	1,715	553
Other hickory	466	249	19	1,851	681	69
Basswood	150	141	25	767	456	131
Hard maple	67	30	1	104	50	3
Soft maple	1,051	793	309	4,700	4,672	1,441
Elm	986	5,014	497	-232	18,050	1,175
White & green ash	2,744	1,871	504	10,868	5,813	1,911
Sycamore	501	641	33	2,799	3,770	173
Cottonwood	2,383	4,527	1,393	13,915	22,729	6,574
Willow	367	441	277	2,956	1,724	1,164
Hackberry	7,545	2,557	676	30,383	9,381	2,733
Black cherry	82	88	1	220	80	7
Black walnut	2,323	906	859	10,462	1,964	4,256
Other hardwoods	1,140	2,439	470	6,933	7,552	1,060
Total hardwoods	26,287	23,509	6,503	114,382	93,157	25,469
All species	27,569	23,607	6,560	115,974	93,487	25,619

[1] An estimate of current gross growth may be computed by adding current mortality to current net growth.

[2] Based on data from a 1993 mill study, regional logging utilization factors, and land-use change estimates from the new inventory.

[3] International 1/4-inch rule.

* Less than 500 cubic feet.

Table 48. -- Current annual removals for 1981 and 1993, and average annual removals for 1981-1993 from growing stock and sawtimber on timberland by softwoods and hardwoods, and Forest Survey Unit, Kansas

Forest Survey Unit and softwoods and hardwoods	Growing stock			Sawtimber		
	Current annual removals 1981[1]	Average annual removals 1981-1993[2]	Current annual removals 1993[1]	Current annual removals 1981[1]	Average annual removals 1981-1993[2]	Current annual removals 1993[1]
	(In thousand cubic feet)			*(In thousand board feet)* [3]		
Northeastern						
Softwoods	40	37	5	132	--	8
Hardwoods	5,999	4,773	2,868	22,920	17,342	10,419
Total	6,039	4,810	2,873	23,052	17,342	10,427
Southeastern						
Softwoods	14	42	37	30	75	90
Hardwoods	6,257	2,038	2,505	24,585	7,386	10,816
Total	6,271	2,080	2,542	24,615	7,461	10,906
Western						
Softwoods	35	--	16	162	--	52
Hardwoods	1,638	1,171	1,129	5,424	5,240	4,234
Total	1,673	1,171	1,145	5,586	5,240	4,286
All Units						
Softwoods	89	79	57	324	75	150
Hardwoods	13,894	7,982	6,503	52,929	29,968	25,469
Total	13,983	8,061	6,560	53,253	30,043	25,619

[1] Based on data from mill surveys and regional logging utilization studies, and land-use change estimates from the field inventory.

[2] Average of field plot level removals between the study periods.

[3] International 1/4-inch rule.

Table 49. -- Current annual mortality for 1981 and 1993, and average annual mortality for 1981-1993 of growing stock and sawtimber on timberland by softwoods and hardwoods, and Forest Survey Unit, Kansas

Forest Survey Unit and softwoods and hardwoods	Growing stock			Sawtimber		
	Current annual mortality	Average annual mortality	Current annual mortality	Current annual mortality	Average annual mortality	Current annual mortality
	1981	1981-1993	1993	1981	1981-1993	1993
Northeastern	*(In thousand cubic feet)*			*(In thousand board feet)* [1]		
Softwoods	8	22	40	34	29	174
Hardwoods	5,800	6,717	8,383	18,675	19,582	30,895
Total	5,808	6,739	8,423	18,709	19,611	31,069
Southeastern						
Softwoods	16	31	55	68	42	142
Hardwoods	4,569	7,860	9,166	12,580	22,290	35,561
Total	4,585	7,891	9,221	12,648	22,332	35,703
Western						
Softwoods	--	3	3	--	--	14
Hardwoods	3,552	5,532	5,960	14,005	18,558	26,701
Total	3,552	5,535	5,963	14,005	18,558	26,715
All Units						
Softwoods	24	56	98	102	71	330
Hardwoods	13,921	20,109	23,509	45,260	60,430	93,157
Total	13,945	20,165	23,607	45,362	60,501	93,487

[1] International 1/4-inch rule.

Table 50. -- Current annual timber removals of growing stock and sawtimber on timberland by species group, product, logging residue, and other removals, Kansas, 1993

Species group	All removals	Growing stock						
		Product					Nonproduct removals	
		All product removals	Saw logs	Veneer logs	Fuelwood	Misc. products	Logging residue	Other removals
		(In thousand cubic feet)						
Softwoods								
Ponderosa pine	*	*	*	--	--	--	*	--
Eastern redcedar	57	33	12	--	21	--	*	24
Total softwoods	57	33	12	--	21	--	*	24
Hardwoods								
Select white oak	674	401	215	30	156	--	68	205
Other white oak	108	39	16	8	15	--	5	64
Select red oak	257	171	87	10	74	--	28	58
Other red oak	270	109	56	9	44	--	18	143
Select hickory	130	4	3	*	1	--	1	125
Other hickory	19	1	1	*	*	--	*	18
Basswood	25	23	15	8	--	--	2	--
Hard maple	1	1	1	--	--	--	*	--
Soft maple	309	189	143	--	43	3	16	104
Elm	497	134	15	--	119	--	2	361
White & green ash	504	309	155	7	147	--	65	130
Sycamore	33	15	15	--	--	--	2	16
Cottonwood	1,393	791	407	4	375	5	62	539
Willow	277	*	*	--	*	--	*	277
Hackberry	676	227	208	--	19	--	23	426
Black cherry	1	1	1	--	--	--	*	--
Black walnut	859	401	326	74	1	--	37	421
Other hardwoods	469	29	20	1	6	2	3	438
Total hardwoods	6,503	2,845	1,684	151	1,000	10	333	3,325
All species	6,560	2,878	1,696	151	1,021	10	333	3,349

(Table 50 continued on next page)

(Table 50 continued)

Species group	All removals	Sawtimber						
		All product removals	Removals for products (items)				Nonproduct removals	
			Saw logs	Veneer logs	Fuelwood	Misc. products	Logging residue	Other removals
			(In thousand board feet) [1]					
Softwoods								
Ponderosa pine	1	1	1	--	--	--	*	--
Eastern redcedar	149	112	55	--	57	--	*	37
Total softwoods	150	113	56	*	57	*	*	37
Hardwoods								
Select white oak	2,303	1,540	982	131	427	--	91	672
Other white oak	188	148	72	33	43	--	7	33
Select red oak	868	642	397	44	201	--	37	189
Other red oak	860	417	259	37	121	--	24	419
Select hickory	553	19	17	*	2	--	3	531
Other hickory	69	5	4	*	1	--	1	63
Basswood	131	129	97	32	--	--	2	--
Hard maple	3	3	3	--	--	--	*	--
Soft maple	1,441	1,036	902	--	119	15	28	377
Elm	1,175	422	93	--	329	--	4	749
White & green ash	1,911	1,346	915	32	399	--	145	420
Sycamore	173	95	95	--	--	--	3	75
Cottonwood	6,574	3,713	2,635	19	1,032	27	127	2,734
Willow	1,164	1	1	--	*	--	*	1,163
Hackberry	2,733	1,363	1,310	--	53	--	39	1,331
Black cherry	7	7	7	--	--	--	*	--
Black walnut	4,256	2,645	2,118	526	1	--	138	1,473
Other hardwoods	1,060	160	125	6	16	13	6	894
Total hardwoods	25,469	13,691	10,032	860	2,744	55	655	11,123
All species	25,619	13,804	10,088	860	2,801	55	655	11,160

* Less than 1/2 unit of measure.

[1] International 1/4-inch rule.

Table 51. -- Total volume of wood fiber used for each primary product by softwoods and hardwoods, and source of material, Kansas, 1993

Product by softwoods and hardwoods	Standard units	Total		Source of material					
				Roundwood products				Plant byproducts[1]	
				Growing stock		Nongrowing stock			
		Number of units	Thousand cubic feet [2]	Number of units	Thousand cubic feet	Number of units	Thousand cubic feet	Number of units	Thousand cubic feet
Saw logs									
Softwoods	*Thousand*	58	12	58	12	*	*	--	--
Hardwoods	*board feet* [3]	12,400	2,017	10,476	1,684	1,924	333	--	--
Total		12,458	2,029	10,534	1,696	1,924	333	--	--
Veneer logs									
Hardwoods	*Thousand*	937	162	860	151	77	11	--	--
Total	*board feet* [3]	937	162	860	151	77	11	--	--
Pulpwood [4]									
Hardwoods	*Standard*	3,596	284	--	--	--	--	3,596	284
Total	*cords* [5]	3,596	284	--	--	--	--	3,596	284
Fuelwood									
Softwoods	*Standard*	2,817	197	296	21	2,467	173	54	4
Hardwoods	*cords* [5]	333,868	23,371	14,289	1,000	311,504	21,805	8,075	565
Total		336,685	23,568	14,585	1,021	313,971	21,978	8,129	569
Posts, poles and pilings									
Softwoods	*Thousand*	1	1	--	--	1	1	--	--
Hardwoods	*cubic feet*	415	415	--	--	415	415	--	--
Total		416	416	--	--	416	416	--	--
Miscellaneous products									
Softwoods	*Thousand*	2	2	--	--	--	--	2	2
Hardwoods	*cubic feet*	413	413	10	10	--	--	403	403
Total		415	415	10	10	--	--	405	405
All products									
Softwoods	*Thousand*				33		174		5
Hardwoods	*cubic feet*				2,845		22,564		1,253
Total					2,878		22,738		1,258

* Less than 1/2 unit of measure.

[1] Includes coarse and fine wood residues.

[2] Column should not be added to avoid double counting volume.

[3] International 1/4-inch rule.

[4] Includes roundwood and plant byproducts for wood pulp.

[5] 128 cubic feet including bark and air space.

Table 52. -- Output of roundwood products by product, softwoods and hardwoods, and source of material, Kansas, 1993

(In thousand cubic feet)

Product by softwoods and hardwoods	All sources	Source of material			
		Growing stock			Non-growing stock
		Total	Sawtimber	Poletimber	
Saw logs					
Softwoods	12	12	12	--	*
Hardwoods	2,017	1,684	1,665	19	333
Total	2,029	1,696	1,677	19	333
Veneer logs					
Hardwoods	162	151	151	--	11
Total	162	151	151	--	11
Fuelwood					
Softwoods	194	21	12	9	173
Hardwoods	22,805	1,000	553	447	21,805
Total	22,999	1,021	565	456	21,978
Posts, poles, and pilings					
Softwoods	1	--	--	--	1
Hardwoods	415	--	--	--	415
Total	416	--	--	--	416
Miscellaneous products					
Hardwoods	10	10	9	1	--
Total	10	10	9	1	--
All products					
Softwoods	207	33	24	9	174
Hardwoods	25,409	2,845	2,378	467	22,564
Total	25,616	2,878	2,402	476	22,738

* Less than 500 cubic feet.

Table 53. -- Timber products from roundwood by species group and product, Kansas, 1993

Species group	All products	Product							
		Saw logs		Veneer logs		Fuelwood		Posts, poles and pilings	Misc. products
	Thousand cubic feet	*Thousand cubic feet*	*Thousand board feet* [1]	*Thousand cubic feet*	*Thousand board feet* [1]	*Thousand cubic feet*	*Standard cords* [2]	*Thousand cubic feet*	*Thousand cubic feet*
Softwoods									
Ponderosa pine	*	*	1	--	--	--	--	--	--
Other yellow pines	47	--	--	--	--	47	670	--	--
Eastern redcedar	160	12	57	--	--	147	2,093	1	--
Total softwoods	207	12	58	--	--	194	2,763	1	--
Hardwoods									
Select white oak	2,888	321	1,799	30	131	2,537	36,240	--	--
Other white oak	376	23	131	8	33	345	4,934	--	--
Select red oak	1,176	130	728	10	44	1,036	14,801	--	--
Other red oak	716	85	475	9	37	622	8,892	--	--
Select hickory	177	3	19	*	*	174	2,481	--	--
Other hickory	52	1	4	*	*	51	732	--	--
Basswood	25	18	112	7	32	--	--	--	--
Hard maple	*	*	3	--	--	--	--	--	--
Soft maple	370	166	1,044	--	--	201	2,869	--	3
Elm	3,579	17	108	--	--	3,562	50,889	--	--
White & green ash	1,671	172	1,005	7	31	1,492	21,321	--	--
Sycamore	18	18	111	--	--	--	--	--	--
Cottonwood	2,750	406	2,634	4	19	2,335	33,344	--	5
Willow	3	*	1	--	--	3	45	--	--
Hackberry	1,124	241	1,517	--	--	883	12,618	--	--
Black cherry	1	1	8	--	--	--	--	--	--
Black walnut	1000	391	2,553	86	602	523	7,481	--	--
Other hardwoods	787	23	144	1	6	761	10,858	--	2
Total hardwoods	16,713	2,016	12,396	162	937	14,525	207,505	--	10
Noncommercial species	8,696	1	4	--	--	8,280	118,288	415	--
All species	25,616	2,029	12,458	162	937	22,999	328,556	416	10

[1] International 1/4-inch rule.

* Less than 1/2 unit of measure.

[2] 128 cubic feet including bark and air space.

Table 54. -- All live tree biomass on timberland by species group and local forest type, Kansas, 1994

(In green tons)

Species group	All types	Local forest type										
		Eastern redcedar	Eastern redcedar-hardwood	Red oak-white oak-hickory	Bur oak	Post-blackjack oak	Cotton-wood	Elm-ash-cotton-wood	Willow	Lowland plains hardwoods	Elm-ash-locust	Non-stocked
Softwoods												
Eastern redcedar	1,038,593	294,285	359,415	81,486	6,791	26,613	1,422	13,193	2,058	101,203	151,861	266
Total softwoods	1,038,593	294,285	359,415	81,486	6,791	26,613	1,422	13,193	2,058	101,203	151,861	266
Hardwoods												
Select white oak	10,416,569	48,806	277,673	5,214,909	897,401	197,207	--	518,290	2,265	1,775,893	1,477,453	6,672
Other white oak	3,384,574	--	23,764	389,323	19,524	2,822,425	--	10,679	--	95,024	23,835	--
Select red oak	5,127,996	4,896	14,329	3,721,701	7,872	197,377	161	90,514	--	495,204	595,942	--
Other red oak	3,774,345	24,163	14,329	1,708,677	--	1,250,352	17,408	65,922	--	296,975	396,519	--
Select hickory	2,835,097	--	26,729	1,570,781	7,445	78,659	--	280,393	--	323,997	547,093	--
Other hickory	1,378,015	74	5,518	677,761	31,115	28,407	--	83,722	--	393,019	158,399	--
Basswood	461,067	--	2,418	150,237	--	75	--	15,186	--	242,616	50,535	--
Hard maple	256,504	--	--	141,814	--	--	--	--	--	113,160	1,530	--
Soft maple	2,946,564	--	--	9,743	--	--	25,801	1,608,675	--	85,862	1,216,483	--
Elm	8,508,679	42,188	213,316	652,825	41,339	100,756	135,002	1,339,508	1,012	1,595,441	4,384,866	2,426
White & green ash	7,456,672	8,438	2,620	514,426	33,386	56,925	47,240	1,706,349	--	971,362	4,115,926	--
Sycamore	2,425,616	--	11,959	154,099	--	3,561	--	801,361	--	379,250	1,075,386	--
Cottonwood	10,669,496	--	302,417	241,931	4,879	--	5,546,985	1,135,661	2,981	939,429	2,489,726	5,487
Willow	1,192,853	--	426	17,193	--	12,329	138,037	417,403	60,157	83,947	463,361	--
Hackberry	11,821,992	23,850	71,937	376,382	34,222	42,286	54,393	1,755,770	--	6,859,307	2,603,845	--
Black cherry	348,857	6,122	3,509	31,208	88	16,642	6,457	46,464	--	125,209	113,158	--
Black walnut	6,197,863	25,447	106,829	821,044	35,398	53,887	18,335	631,500	--	3,406,563	1,098,860	--
Other hardwoods	9,795,394	11,906	151,607	590,741	21,898	50,875	287,498	1,922,442	851	1,825,761	4,931,815	--
Total hardwoods	88,998,153	195,890	1,229,380	16,984,795	1,134,567	4,911,763	6,277,317	12,429,839	67,266	20,008,019	25,744,732	14,585
Noncommercial species	4,681,504	30,277	246,478	511,316	1,518	105,176	8,300	304,163	910	1,272,642	2,200,724	--
All species	94,718,250	520,452	1,835,273	17,577,597	1,142,876	5,043,552	6,287,039	12,747,195	70,234	21,381,864	28,097,317	14,851

Table 55. -- All live tree biomass on timberland by species group and tree biomass component, Kansas, 1994

(In green tons)

Species group	All components	Tree biomass component						
		All live 1-5-inch trees	Growing-stock trees			Nongrowing-stock trees		
			Stumps	Boles	Tops and limbs	Stumps	Boles	Tops and limbs
Softwoods								
Eastern redcedar	1,038,593	279,584	50,324	399,082	126,515	14,666	131,455	36,967
Total softwoods	1,038,593	279,584	50,324	399,082	126,515	14,666	131,455	36,967
Hardwoods								
Select white oak	10,416,569	254,063	391,431	4,668,596	1,257,171	243,085	2,837,804	764,419
Other white oak	3,384,574	289,533	190,392	1,623,849	548,239	56,455	512,646	163,460
Select red oak	5,127,996	146,107	211,539	2,813,871	779,238	63,165	885,581	228,495
Other red oak	3,774,345	244,487	148,204	1,794,294	523,764	65,076	776,918	221,602
Select hickory	2,835,097	264,330	128,004	1,458,313	469,161	29,225	375,739	110,325
Other hickory	1,378,015	205,820	60,395	669,615	223,505	13,044	156,264	49,372
Basswood	461,067	25,903	17,642	216,530	63,493	8,152	100,187	29,160
Hard maple	256,504	49,062	10,107	109,885	38,279	3,051	34,397	11,723
Soft maple	2,946,564	75,675	71,499	1,207,968	306,249	56,805	1,002,078	226,290
Elm	8,508,679	1,666,670	287,458	2,368,383	798,736	265,485	2,365,785	756,162
White & green ash	7,456,672	540,941	265,318	3,348,677	1,000,925	127,085	1,686,257	487,469
Sycamore	2,425,616	21,827	71,098	1,406,158	326,710	23,530	473,639	102,654
Cottonwood	10,669,496	10,243	439,405	6,327,888	1,470,100	124,379	1,899,997	397,484
Willow	1,192,853	20,841	44,630	511,539	145,275	31,254	340,386	98,928
Hackberry	11,821,992	825,155	560,010	5,513,791	1,646,146	232,817	2,356,527	687,546
Black cherry	348,857	27,600	12,113	113,309	39,181	9,901	112,447	34,306
Black walnut	6,197,863	260,568	270,603	2,941,367	925,724	114,598	1,296,170	388,833
Other hardwoods	9,795,394	681,081	210,869	2,362,264	724,825	356,280	4,215,604	1,244,471
Total hardwoods	88,998,153	5,609,906	3,390,717	39,456,297	11,286,721	1,823,387	21,428,426	6,002,699
Noncommercial species	4,681,504	845,568	--	--	--	265,578	2,707,481	862,877
All species	94,718,250	6,735,058	3,441,041	39,855,379	11,413,236	2,103,631	24,267,362	6,902,543

Table 56. -- Sampling errors [1] for Forest Survey Unit and county/county group totals of area of timberland, volume, average annual net growth, and average annual removals on timberland, Kansas, 1994

(Sampling error in percent)

Forest Survey Unit and county/county group	Area	Growing stock			Sawtimber		
		Volume	Average annual net growth	Average annual removals	Volume	Average annual net growth	Average annual removals
Northeastern							
Atchison	9.9	16.5	26.9	51.9	19.7	26.2	46.7
Clay Center [2]	7.8	14.0	18.4	*	16.9	22.3	--
Doniphan	8.6	14.7	24.7	46.5	17.6	26.2	36.0
Douglas	9.4	16.9	24.4	65.0	21.4	29.0	52.1
Franklin	9.5	17.1	20.7	55.0	21.7	25.2	58.9
Jackson	9.2	18.1	19.1	46.0	22.1	22.3	43.4
Jefferson	7.6	12.6	21.1	63.8	15.1	22.3	50.4
Johnson-Wyandotte	8.4	14.9	19.2	52.9	18.8	21.7	47.1
Leavenworth	8.0	13.2	19.1	45.6	15.8	22.9	32.9
Marshall	9.2	16.5	20.5	59.4	20.2	25.1	66.2
Miami	7.4	13.0	19.3	51.8	16.3	25.9	77.9
Nemaha-Brown	8.8	15.5	25.8	75.2	18.8	31.7	48.6
Osage	8.4	14.8	19.9	76.0	18.8	24.4	76.3
Pottawatomie	7.6	14.9	28.6	65.7	18.3	38.1	--
Riley-Geary	7.2	12.6	22.5	95.1	15.1	31.8	66.0
Shawnee	9.8	19.1	22.0	72.8	23.3	29.3	77.2
Wabaunsee	8.8	17.3	33.1	*	21.2	47.9	94.8
Total	2.0	3.6	5.3	14.7	4.5	6.4	13.3
Southeastern							
Anderson	16.9	24.3	38.9	94.4	32.0	55.3	*
Bourbon	13.2	18.6	26.8	82.7	24.5	32.5	--
Butler	19.2	28.7	38.9	57.3	36.7	53.6	42.0
Chautauqua	13.7	19.8	30.9	72.5	26.0	44.2	*
Cherokee	13.5	18.8	17.6	69.1	24.0	21.7	59.0
Coffey	20.4	23.4	29.5	*	27.9	40.2	*
Cowley	19.0	27.7	50.8	--	35.6	55.2	--
Crawford	13.9	19.4	36.4	70.9	24.9	44.6	55.9
Elk	17.6	25.5	36.3	*	33.2	43.8	--
Emporia [3]	12.1	13.8	29.5	49.5	16.3	33.4	38.8
Greenwood	17.7	26.0	32.0	85.2	33.5	46.0	70.0
Labette	15.1	21.2	90.7	*	27.3	70.0	--
Linn	11.7	16.4	22.5	52.4	21.6	28.4	57.2
Montgomery	13.0	18.6	27.2	*	23.9	28.5	*
Neosho	16.5	23.3	31.7	*	30.0	41.8	*
Wilson	13.0	19.0	25.5	99.4	24.7	33.3	76.4
Woodson-Allen	13.9	20.3	26.6	68.5	26.6	36.8	79.7
Total	3.6	4.9	7.2	19.9	6.3	8.9	18.7
Western							
Colby-Garden City-Dodge City [4]	32.4	35.4	*	*	35.8	97.7	57.3
Great Bend-Hutchinson [5]	22.8	35.3	55.5	--	39.6	56.8	--
Hays [6]	16.5	23.1	36.8	--	25.5	41.2	--
Jewell-Mitchell	23.1	30.1	46.7	--	32.8	73.9	--
Republic-Cloud	23.9	30.9	36.5	--	33.7	35.1	--
Salina [7]	24.9	32.1	39.3	62.6	35.1	41.1	*
Wichita [8]	19.2	28.9	35.4	85.0	31.6	38.7	51.9
Total	8.3	11.3	16.4	45.6	12.3	17.5	36.6
All counties	2.2	3.4	4.9	13.5	4.1	5.9	12.3

* Indicates a sampling error over 99.9 percent.

[1] Sampling error is not calculated when the estimated removals are equal to 0.

[2] Includes: Clay, Dickinson, and Washington counties.

[3] Includes: Chase, Lyon, Marion, and Morris counties.

[4] Includes: Cheyenne, Clark, Comanche, Decatur, Finney, Ford, Gove, Grant, Gray, Greeley, Hamilton, Haskell, Hodgeman, Kearny, Kiowa, Lane, Logan, Meade, Morton, Ness, Rawlins, Scott, Seward, Sheridan, Sherman, Stanton, Stevens, Thomas, Wallace, and Wichita counties.

[5] Includes: Barton, Edwards, Harvey, McPherson, Pawnee, Reno, Rice, Rush, and Stafford counties.

[6] Includes: Ellis, Graham, Norton, Osborne, Phillips, Rooks, Russell, Smith, and Trego counties.

[7] Includes: Ellsworth, Lincoln, Ottawa, and Saline counties.

[8] Includes: Barber, Harper, Kingman, Pratt, Sedgwick, and Sumner counties.

Table 57.-- Area of land by river basin and major land-use class, Kansas, 1994

(In thousand acres)

River basin	Total land area[1]	Forest land				Other land [2]
		Total forest	Timberland	Reserved forest land	Other forest land	
Cimarron	2,898.9	12.2	11.5	--	0.7	2,886.7
Kansas-Lower Republican	6,171.3	416.3	400.3	8.6	7.4	5,754.9
Lower Arkansas	8,136.7	73.2	73.2	--	--	8,063.5
Marais Des Cygnes	2,227.8	274.9	270.9	--	4.0	1,952.9
Missouri	1,315.8	87.7	87.7	--	--	1,228.1
Neosho	3,682.2	246.3	246.3	--	--	3,435.9
Smokey Hill-Saline	7,287.2	72.8	72.0	--	0.8	7,214.4
Solomon	5,257.9	72.6	63.8	8.8	--	5,185.3
Upper Arkansas	6,838.3	6.2	3.4	--	2.8	6,832.1
Upper Republican	3,931.8	6.1	6.1	--	--	3,925.7
Verdigris	2,530.3	234.8	213.5	--	21.3	2,295.5
Walnut	2,088.3	43.0	43.0	--	--	2,045.3
Total	52,366.5	1,546.1	1,491.7	17.4	37.0	50,820.3

[1] From U. S. Bureau of the Census, 1990.

[2] Includes 91.4 thousand acres of water according to FIA standards of area classification, but defined by the Bureau of the Census as land.

Table 58. -- Area of timberland by river basin and local forest type, Kansas, 1994

(In thousand acres)

River basin	All types	Local forest type										
		Eastern redcedar	Eastern redcedar-hardwood	Red oak-white oak-hickory	Bur oak	Post-blackjack oak	Cotton-wood	Elm-ash-cotton-wood	Willow	Lowland plains hardwoods	Elm-ash-locust	Non-stocked
Cimarron	11.5	--	--	--	--	--	10.4	--	--	--	1.1	23.0
Kansas-Lower Republican	400.3	6.6	12.2	81.7	10.6	1.7	13.4	34.7	2.9	83.8	149.8	2.9
Lower Arkansas	73.2	1.5	5.6	1.2	--	0.9	10.3	1.1	0.1	17.3	33.1	2.1
Marais Des Cygnes	270.9	10.7	15.0	70.9	0.3	3.4	0.5	27.8	--	59.5	81.1	1.7
Missouri	87.7	0.2	0.9	25.1	2.0	1.1	1.4	7.4	0.3	22.8	26.1	0.4
Neosho	246.3	1.2	8.6	43.3	--	7.0	10.7	40.2	--	59.0	76.3	--
Smokey Hill-Saline	72.0	--	--	2.7	2.4	--	12.8	11.2	--	18.3	24.6	--
Solomon	63.8	--	--	11.0	--	--	2.8	9.1	--	8.5	32.4	--
Upper Arkansas	3.4	--	--	--	--	--	1.7	1.0	--	--	0.7	--
Upper Republican	6.1	--	--	--	--	--	1.5	--	--	2.0	2.6	--
Verdigris	213.5	2.8	3.5	31.4	0.2	74.9	--	22.9	--	35.3	42.2	0.3
Walnut	43.0	--	--	2.8	0.1	0.8	--	11.0	--	19.5	8.8	--
Total	1,491.7	23.0	45.8	270.1	15.6	89.8	65.5	166.4	3.3	326.0	478.8	7.4

Table 59. -- Net volume of growing stock on timberland by river basin and major species group, Kansas, 1994

(In thousand cubic feet)

River basin	All species	Eastern redcedar	Select white oak	Other white oak	Select red oak	Other red oak	Select hickory	Other hickory	Bass-wood	Hard maple	Soft maple	Elm	White & green ash	Sycamore	Cotton-wood	Willow	Hack-berry	Black cherry	Black walnut	Other hardwoods
Cimarron	21,806	--	--	--	--	--	--	--	--	--	--	--	--	--	20,449	--	--	--	--	1,357
Kansas-Lower Republican	340,357	6,109	53,557	2,029	15,108	8,586	8,350	7,468	2,605	654	8,853	20,493	22,193	14,011	60,964	3,882	50,405	380	26,686	28,024
Lower Arkansas	55,626	430	194	--	--	--	--	--	--	--	--	5,076	2,438	514	31,873	672	3,256	--	2,354	8,819
Marais Des Cygnes	228,789	8,321	24,118	5,559	26,097	11,424	13,626	4,969	1,281	1,445	9,025	14,479	19,496	13,508	5,626	603	28,476	1,033	25,808	13,895
Missouri	82,873	78	11,615	1,149	11,042	3,623	3,657	2,843	4,304	125	639	5,528	2,725	2,775	8,918	851	8,546	430	8,231	5,794
Neosho	214,649	444	19,453	6,682	8,793	13,650	10,392	2,569	--	802	11,815	14,135	25,293	6,418	20,586	2,651	39,067	2,025	15,494	14,380
Smokey Hill-Saline	71,485	57	6,274	--	--	--	--	--	--	--	2,936	3,094	10,418	332	25,957	1,798	14,377	--	1,498	4,744
Solomon	54,418	--	3,910	--	--	--	--	--	--	--	--	4,275	11,779	--	21,425	2,546	7,445	--	913	2,125
Upper Arkansas	3,072	--	--	--	--	--	--	--	--	--	--	462	56	--	2,292	--	137	--	--	125
Upper Republican	4,335	--	--	--	--	--	--	--	--	--	--	--	620	--	2,849	--	220	--	646	--
Verdigris	140,576	1,148	13,067	31,577	13,330	9,643	3,747	2,017	469	87	4,347	5,921	9,684	5,236	3,364	1,856	19,568	304	10,574	4,637
Walnut	37,338	--	2,422	--	655	493	237	--	--	--	--	1,316	5,555	1,446	7,185	3,169	9,967	--	2,215	2,679
Total	1,255,324	16,587	134,610	46,996	75,025	47,419	40,009	19,865	8,659	3,113	37,615	74,779	110,257	44,240	211,488	18,028	181,464	4,172	94,419	86,579

Table 60. -- Net volume of sawtimber on timberland by river basin and major species group, Kansas, 1994

(In thousand board feet [1])

River basin	All species	Eastern redcedar	Select white oak	Other white oak	Select red oak	Other red oak	Select hickory	Other hickory	Bass-wood	Hard maple	Soft maple	Elm	White & green ash	Sycamore	Cotton-wood	Willow	Hack-berry	Black cherry	Black walnut	Other hardwoods
Cimarron	102,907	--	--	--	--	--	--	--	--	--	--	--	--	--	100,087	--	--	--	--	2,820
Kansas-Lower Republican	1,199,593	10,909	218,243	5,769	58,126	32,704	13,985	13,936	10,383	1,109	36,660	32,584	62,263	66,078	305,673	11,844	159,798	1,221	72,016	86,292
Lower Arkansas	220,537	1,114	937	--	--	--	--	--	--	--	--	14,483	6,704	2,537	155,503	1,760	8,738	--	6,447	22,314
Marais Des Cygnes	738,517	15,667	83,962	7,688	109,409	48,905	37,121	12,174	5,124	2,441	34,775	22,130	61,960	67,674	28,024	2,410	93,881	1,439	66,767	36,966
Missouri	303,205	--	50,871	5,007	50,597	15,648	8,010	8,034	16,618	462	2,570	10,588	7,940	13,495	42,731	2,674	21,466	1,816	27,481	17,197
Neosho	771,182	240	86,514	22,696	34,546	48,484	33,479	7,033	--	1,783	50,490	32,735	84,558	31,318	94,152	10,877	137,114	1,902	51,018	42,243
Smokey Hill-Saline	268,175	261	28,811	--	--	--	--	--	--	--	14,377	4,233	34,333	1,244	117,798	4,682	47,197	--	2,879	12,360
Solomon	207,079	--	20,123	--	--	--	--	--	--	--	--	10,717	35,585	--	102,056	11,598	21,660	--	3,794	1,546
Upper Arkansas	12,261	--	--	--	--	--	--	--	--	--	--	1,716	--	--	10,267	--	--	--	--	278
Upper Republican	20,387	--	--	--	--	--	--	--	--	--	--	--	3,017	--	14,125	--	1,121	--	2,124	--
Verdigris	408,092	2,586	54,830	59,660	46,902	19,273	10,477	5,571	1,156	360	19,817	14,469	20,176	25,184	17,050	7,581	60,686	617	34,251	7,446
Walnut	145,366	--	10,370	--	3,156	778	1,230	--	--	--	--	2,189	16,218	7,593	38,384	11,488	39,763	--	6,076	8,121
Total	4,397,301	30,777	554,661	100,820	302,736	165,792	104,302	46,748	33,281	6,155	158,689	145,844	332,754	215,123	1,025,850	64,914	591,424	6,995	272,853	237,583

[1] International 1/4-inch rule.

Table 61. -- Net volume of growing stock on timberland by Forest Survey Unit, county/county group, and major species group, Kansas, 1994

(In thousand cubic feet)

Forest Survey Unit and county/county group	All species	Eastern redcedar	Select white oak	Other white oak	Select red oak	Other red oak	Select hickory	Other hickory	Bass-wood	Hard maple	Soft maple	Elm	White & green ash	Sycamore	Cotton-wood	Willow	Hack-berry	Black cherry	Black walnut	Other hardwoods
Northeastern																				
Atchison	23,671	14	3,041	389	3,346	1,528	1,156	873	1,070	31	1,052	1,580	596	1,402	1,544	290	1,674	49	2,673	1,363
Clay Center [1]	32,942	1,263	5,890	--	--	--	--	133	464	--	64	2,508	3,143	361	5,877	673	8,112	--	1,516	2,939
Doniphan	29,920	19	3,885	521	4,119	2,019	1,523	1,104	1,361	41	948	2,108	824	1,745	1,935	293	2,130	66	3,527	1,754
Douglas	22,481	476	2,818	241	2,335	920	1,179	536	77	261	917	1,620	1,214	1,689	524	126	2,935	106	2,708	1,800
Franklin	22,056	458	2,747	212	2,264	856	1,158	536	69	251	979	1,619	1,196	1,682	507	101	2,926	97	2,637	1,764
Jackson	19,645	290	3,376	100	495	338	500	488	108	--	518	1,404	1,169	888	2,300	72	3,710	33	1,906	1,950
Jefferson	40,351	23	4,786	626	5,446	2,455	1,898	1,467	1,639	50	1,349	2,785	1,107	2,490	3,453	1,145	2,791	79	4,302	2,460
Johnson-Wyandotte	29,140	608	3,720	349	3,003	1,288	1,535	705	83	340	1,226	2,066	1,592	2,233	686	96	3,791	124	3,437	2,258
Leavenworth	36,689	21	4,360	572	4,931	2,245	1,736	1,332	1,495	46	1,257	2,529	1,007	2,255	3,120	1,017	2,538	73	3,921	2,235
Marshall	23,516	376	3,841	--	773	487	645	626	435	--	1,022	1,239	1,163	515	2,504	298	5,554	135	1,590	2,311
Miami	38,370	835	4,937	400	3,978	1,538	2,051	937	113	475	1,493	2,667	2,153	2,944	949	131	5,000	172	4,599	2,999
Nemaha-Brown	26,779	420	4,671	--	855	394	626	692	558	--	1,078	1,554	1,335	563	3,038	306	5,997	174	1,783	2,737
Osage	29,274	604	3,716	346	3,007	1,287	1,537	710	81	335	1,272	2,100	1,590	2,244	679	96	3,826	123	3,446	2,276
Pottawatomie	28,964	456	4,808	130	736	530	745	733	157	--	725	2,073	1,762	1,283	3,250	90	5,603	52	2,871	2,960
Riley-Geary	40,677	1,967	8,215	--	--	--	--	188	224	--	107	2,516	3,384	477	7,658	597	9,571	--	2,055	3,717
Shawnee	17,604	271	3,011	84	450	306	443	435	94	--	448	1,251	1,043	792	2,127	60	3,307	30	1,713	1,742
Wabaunsee	21,387	313	3,551	124	498	355	552	537	121	--	606	1,588	1,276	939	2,645	90	4,047	35	1,998	2,114
Total	483,466	8,414	71,373	4,094	36,237	16,545	17,283	12,030	8,148	1,828	15,060	33,204	25,553	24,502	42,796	5,481	73,511	1,348	46,680	39,379
Southeastern																				
Anderson	21,372	902	2,294	1,127	2,478	1,273	1,121	557	9	195	567	1,272	2,328	1,021	334	80	2,389	92	2,534	799
Bourbon	36,635	1,632	3,848	1,923	4,307	2,302	2,056	954	16	353	999	2,098	3,897	1,801	605	144	3,779	166	4,380	1,377
Butler	15,373	9	1,088	2,367	862	582	205	226	--	--	231	424	1,410	629	2,204	940	2,695	8	863	634
Chautauqua	32,206	27	3,129	6,647	2,019	1,632	604	461	--	--	681	943	2,825	1,542	1,224	694	6,153	23	2,279	1,324
Cherokee	35,936	274	2,266	3,156	2,753	2,839	2,128	339	64	--	1,864	2,247	3,967	901	4,221	530	4,202	376	1,935	1,874
Coffey	23,091	71	3,116	--	313	727	528	297	34	--	1,126	1,259	2,160	507	805	170	7,308	--	2,557	2,115
Cowley	16,458	11	1,295	2,740	969	672	251	205	--	--	283	460	1,503	716	1,859	820	2,993	9	980	691
Crawford	33,595	260	2,154	2,979	2,661	2,662	2,039	320	60	--	1,772	2,221	3,708	854	3,499	495	3,940	370	1,815	1,788
Elk	19,529	16	1,799	3,815	1,205	936	348	270	--	--	393	565	1,733	912	1,140	571	3,685	14	1,321	808
Emporia [2]	66,864	184	9,218	--	809	1,880	1,367	768	83	--	2,911	3,670	6,981	2,634	2,082	439	20,084	--	7,092	6,662
Greenwood	18,780	13	1,543	3,302	1,110	811	295	263	--	--	333	531	1,694	827	1,844	830	3,429	11	1,168	777
Labette	28,134	219	1,752	2,401	2121.3	2,237	1,670	259	49	--	1,501	1,862	3,154	714	3,053	406	3,407	350	1,475	1,507
Linn	47,370	2,144	4,948	2,487	5,597	3,024	2,653	1,234	20	465	1,304	2,696	5,007	2,350	795	190	4,770	218	5,682	1,787
Montgomery	36,768	274	2,394	3,227	3,287	2,847	2,343	335	63	--	1,871	2,860	3,851	900	3,646	516	4,121	398	1,903	1,933
Neosho	23,281	181	1,436	1,959	1,740	1,848	1,376	212	40	--	1,243	1,557	2,599	588	2,590	331	2,832	300	1,203	1,247
Wilson	35,136	268	2,275	3,149	2,912	2,827	2,173	336	63	--	1,823	2,406	4,148	884	2,969	539	4,235	360	1,920	1,850
Woodson-Allen	30,848	1,258	3,331	1,624	3,646	1,775	1,572	801	12	272	802	1,880	3,386	1,445	467	111	3,570	128	3,624	1,145
Total	521,376	7,743	47,884	42,902	38,788	30,874	22,726	7,835	511	1,285	19,704	28,950	54,349	19,224	33,336	7,806	83,590	2,824	42,731	28,314
Western																				
Colby-Garden City-Dodge City [3]	25,573	77	--	--	--	--	--	--	--	--	--	--	622	--	23,296	--	220	--	--	1,358
Great Bend-Hutchinson [4]	25,778	129	208	--	--	--	--	--	--	--	--	2,534	1,698	189	13,437	276	1,653	--	985	4,668
Hays [5]	60,398	--	2,620	--	--	--	--	--	--	--	--	3,678	9,704	--	34,401	2,727	5,044	--	1,254	970
Jewell-Mitchell	35,497	--	4,300	--	--	--	--	--	--	--	1,007	1,101	5,333	--	15,431	446	5,217	--	508	2,153
Republic-Cloud	33,647	--	4,154	--	--	--	--	--	--	--	973	1,075	5,208	--	14,174	432	5,042	--	490	2,099
Salina [6]	31,173	--	3,715	--	--	--	--	--	--	--	870	1,097	5,087	--	13,053	386	4,507	--	439	2,020
Wichita [7]	38,416	224	356	--	--	--	--	--	--	--	--	3,141	2,704	325	21,564	474	2,679	--	1,332	5,617
Total	250,482	430	15,353	--	--	--	--	--	--	--	2,851	12,625	30,355	514	135,356	4,741	24,363	--	5,008	18,886
All counties	1,255,324	16,587	134,610	46,996	75,025	47,419	40,009	19,865	8,659	3,113	37,615	74,779	110,257	44,240	211,488	18,028	181,464	4,172	94,419	86,579

[1] Includes: Clay, Dickerson, and Washington counties.

[2] Includes: Chase, Lyon, Marion, and Morris counties.

[3] Includes: Cheyenne, Clark, Comanche, Decatur, Finney, Ford, Gove, Grant, Gray, Greeley, Hamilton, Haskell, Hodgeman, Kearny, Kiowa, Lane, Logan, Meade, Morton, Ness, Rawlins, Scott, Seward, Sheridan, Sherman, Stanton, Stevens, Thomas, Wallace, and Wichita counties.

[4] Includes: Barton, Edwards, Harvey, McPherson, Pawnee, Reno, Rice, Rush, and Stafford counties.

[5] Includes: Ellis, Graham, Norton, Osborne, Phillips, Rooks, Russell, Smith, and Trego counties.

[6] Includes: Ellsworth, Lincoln, Ottawa, and Saline counties.

[7] Includes: Barber, Harper, Kingman, Pratt, Sedgwick, and Sumner counties.

Table 62. -- Net volume of sawtimber on timberland by Forest Survey Unit, county/county group, and major species group, Kansas, 1994

(In thousand board feet) [1]

Forest Survey Unit and county/county group	All species	Eastern redcedar	Select white oak	Other white oak	Select red oak	Other red oak	Select hickory	Other hickory	Bass-wood	Hard maple	Soft maple	Elm	White & green ash	Sycamore	Cotton-wood	Willow	Hack-berry	Black cherry	Black walnut	Other hardwoods
Northeastern																				
Atchison	85,039	--	13,245	1,492	15,066	6,230	2,130	1,951	4,986	43	4,848	2,576	1,631	6,628	7,337	843	4,297	188	7,674	3,877
Clay Center [2]	115,213	2,238	25,286	--	--	--	--	--	--	--	279	3,774	13,013	1,388	29,915	2,575	24,315	--	4247	8,184
Doniphan	105,794	--	16,784	2,000	18,433	8,204	2,744	2,551	6,275	57	4,236	3,339	2,147	8,227	9,132	779	5,484	252	9,961	5,190
Douglas	71,697	1,128	9,800	413	9,566	3,715	2,432	1,241	290	452	3,695	2,181	2,771	8,609	2,695	548	9,635	235	7,180	5,111
Franklin	69,866	1,078	9,492	368	9,157	3,460	2,314	1,194	252	434	3,959	2,256	2,694	8,623	2,593	440	9,522	226	6,902	4,904
Jackson	67,372	648	13,575	366	1,435	1,285	1,211	1,187	279	--	1,650	2,696	3,793	3,992	11,607	--	11,233	89	5,628	6,697
Jefferson	143,983	--	20,651	2,402	23,797	9,996	3,635	3,070	7,579	68	6,189	4,584	2,897	11,659	16,845	3,893	7,030	302	12,518	6,868
Johnson-Wyandotte	92,673	1,404	12,908	590	12,280	5,222	3,084	1,619	286	588	4,945	2,894	3,632	11,335	3,516	421	12,529	306	8,892	6,224
Leavenworth	130,892	--	18,795	2,201	21,552	9,139	3,308	2,806	6,895	63	5,782	4,173	2,642	10,557	15,193	3,443	6,398	277	11,418	6,250
Marshall	80,161	627	14,986	--	3,708	2,335	1,254	1,073	1,645	--	4,234	2,030	2,784	2,688	12,676	918	16,676	545	4,551	7,433
Miami	123,001	1,924	17,224	694	16,425	6,217	4,288	2,254	395	820	5,997	3,680	4,982	15,026	4,893	575	16,791	426	12,028	8,365
Nemaha-Brown	92,993	744	18,595	--	4,055	1,828	1,253	1,173	2,243	--	4,563	2,668	3,189	2,940	15,322	1,348	18,359	671	5,142	8,901
Osage	92,825	1,399	12,861	585	12,236	5,219	3,048	1,598	286	582	5,140	2,958	3,596	11,410	3,472	426	12,562	302	8,895	6,250
Pottawatomie	98,062	900	19,182	482	2,043	2,014	1,791	1,716	438	--	2,368	3,772	5,711	5,711	16,070	--	17,115	140	8,523	10,088
Riley-Geary	143,822	3,200	34,974	--	--	--	--	--	--	--	466	3,119	13,275	1,713	39,207	2,225	29,586	--	5,779	10,279
Shawnee	60,403	590	12,146	308	1,305	1,164	1,070	1,039	253	--	1,440	2,368	3,376	3,547	10,651	--	10,050	80	5,054	5,962
Wabaunsee	72,780	616	14,030	449	1,390	1,349	1,347	1,349	295	--	1,889	2,974	4,147	4,261	13,158	--	12,138	93	5,973	7,320
Total	1,646,576	16,497	284,534	12,348	152,447	67,376	34,909	25,819	32,395	3,106	61,679	52,041	76,278	118,314	214,282	18,434	223,718	4,131	130,364	117,904
Southeastern																				
Anderson	66,813	1,572	7,763	1,581	10,409	4,903	3,018	1,460	44	463	2,121	2,348	7,764	5,088	1,550	321	7,602	53	6,820	1,932
Bourbon	113,917	2,842	12,997	2,747	17,667	8,868	5,597	2,527	79	839	3,836	3,513	12,771	8,968	2,804	581	11,702	95	12,226	3,259
Butler	50,869	28	4,536	4,103	3,389	1,216	475	666	--	--	1,045	536	2,705	3,177	11,693	3,460	10,139	--	2,358	1,344
Chautauqua	101,013	82	13,009	11,369	7,928	3,337	1,402	1,437	--	--	3,086	1,583	7,877	7,919	6,268	2,743	23,161	--	6,934	2,879
Cherokee	118,867	490	9,597	8,612	9,617	8,659	6,965	745	--	--	7,610	5,780	12,305	3,907	19,751	2,060	12,257	476	5,421	4,616
Coffey	87,671	--	14,140	--	1,365	2,716	2,069	909	167	--	5,228	3,190	6,860	2,610	4,100	738	27,330	--	9,566	6,684
Cowley	53,927	34	5,382	4,675	3,828	1,370	583	633	--	--	1,283	658	3,268	3,641	9,824	3,052	11,340	--	2,881	1,476
Crawford	110,359	460	9,123	8,123	9,397	8,204	6,632	699	--	--	7,245	5,531	11,594	3,704	16,103	1,922	11,738	447	5,082	4,356
Elk	62,003	47	7,478	6,517	4,739	1,911	808	839	--	--	1,778	912	4,534	4,673	5,934	2,196	13,894	--	3,994	1,749
Emporia [3]	256,532	--	40,844	--	3,529	7,022	5,350	2,350	431	--	13,519	8,746	24,597	14,076	10,601	1,909	74,623	--	26,626	22,309
Greenwood	60,830	40	6,421	5,672	4,368	1,670	686	799	--	--	1,509	774	3,869	4,211	9,723	3,105	12,920	--	3,397	1,665
Labette	91,989	373	7,371	6,551	7,418	6,992	5,284	567	--	--	6,166	4,839	9,513	3,104	13,876	1,574	10,274	362	4,132	3,593
Linn	146,787	3,734	16,700	3,568	22,699	11,652	7,102	3,279	104	1,102	5,041	4,351	16,324	11,699	3,684	764	14,637	125	16,026	4,197
Montgomery	119,821	483	10,208	8,772	12,161	8,629	7,671	734	--	--	7,656	5,852	12,190	3,906	16,755	2,003	12,426	469	5,324	4,583
Neosho	76,084	305	6,033	5,345	6,091	5,793	4,312	463	--	--	5,113	4,044	7,793	2,562	11,737	1,285	8,593	296	3,373	2,949
Wilson	112,402	483	9,676	8,581	10,286	8,635	7,192	734	--	--	7,438	5,687	12,107	3,830	13,223	2,100	12,028	469	5,396	4,537
Woodson-Allen	96,716	2,193	11,290	2,256	15,399	6,840	4,248	2,088	62	646	2,959	3,598	11,389	7,197	2,163	448	11,508	74	9,561	2,797
Total	1,726,600	13,166	192,567	88,472	150,289	98,416	69,393	20,929	886	3,049	82,633	61,942	167,461	94,272	159,788	30,260	286,173	2,864	129,115	74,924
Western																				
Colby-Garden City-Dodge City [4]	121,580	407	--	--	--	--	--	--	--	--	--	--	3,017	--	114,215	--	1,120	--	--	2,821
Great Bend-Hutchinson [5]	99,553	259	847	--	--	--	--	--	--	--	--	7,024	5,603	933	64,953	776	5,006	--	2,368	11,785
Hays [6]	239,395	--	13,389	--	--	--	--	--	--	--	--	9,272	29,487	--	156,953	9,902	15,902	--	4,491	--
Jewell-Mitchell	144,547	--	21,862	--	--	--	--	--	--	--	5,080	2,137	13,941	--	75,692	1,487	17,989	--	1,214	5,144
Republic-Cloud	136,921	--	21,118	--	--	--	--	--	--	--	4,908	2,078	13,662	--	70,164	1,437	17,377	--	1,173	5,004
Salina [7]	126,614	--	18,888	--	--	--	--	--	--	--	4,389	2,175	13,685	--	64,869	1,285	15,541	--	1,049	4,732
Wichita [8]	155,515	448	1,456	--	--	--	--	--	--	--	--	9,175	9,620	1,604	104,934	1,333	8,599	--	3,079	15,269
Total	1,024,125	1,114	77,560	--	--	--	--	--	--	--	14,377	31,861	89,015	2,537	651,780	16,220	81,533	--	13,374	44,755
All counties	4,397,301	30,777	554,661	100,820	302,736	165,792	104,302	46,748	33,281	6,155	158,689	145,844	332,754	215,123	1,025,850	64,914	591,424	6,995	272,853	237,583

[1] International 1/4-inch rule.

[2] Includes: Clay, Dickinson, and Washington counties.

[3] Includes: Chase, Lyon, Marion, and Morris counties.

[4] Includes: Cheyenne, Clark, Comanche, Decatur, Finney, Ford, Gove, Grant, Gray, Greeley, Hamilton, Haskell, Hodgeman, Kearny, Kiowa, Lane, Logan, Meade, Morton, Ness, Rawlins, Scott, Seward, Sheridan, Sherman, Stanton, Stevens, Thomas, Wallace, and Wichita counties.

[5] Includes: Barton, Edwards, Harvey, McPherson, Pawnee, Reno, Rice, Rush, and Stafford counties.

[6] Includes: Ellis, Graham, Norton, Osborne, Phillips, Rooks, Russell, Smith, and Trego counties.

[7] Includes: Ellsworth, Lincoln, Ottawa, and Saline counties.

[8] Includes: Barber, Harper, Kingman, Pratt, Sedgwick, and Sumner counties.

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Leatherberry, Earl C.; Schmidt, Thomas L.; Strickler, John K.; Aslin, Raymond G.

1999. **An analysis of the forest resources of Kansas.** Res. Pap. NC-334. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 114 p.

The fourth inventory of Kansas' forests reports 52.4 million acres of land, of which 1.5 million acres are forested. Presents an indepth analysis of the forest resources and contains detailed tables of area volume, growth, removals, mortality, and ownership.

KEY WORDS: Forest area, timber volume, growth, removals, mortality.

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Our job at the North Central Forest Experiment Station is discovering and creating new knowledge and technology in the field of natural resources and conveying this information to the people who can use it. As a new generation of forests emerges in our region, managers are confronted with two unique challenges: (1) Dealing with the great diversity in composition, quality, and ownership of the forests, and (2) Reconciling the conflicting demands of the people who use them. Helping the forest manager meet these challenges while protecting the environment is what research at North Central is all about.